INTERNATIONAL ABSTRACT OF SURGERY

VOLUME 70 MAY, 1940 NUMBER 5

COLLECTIVE REVIEW

THE USE OF X-RAYS IN OBSTETRICAL DIAGNOSIS, WITH PARTICULAR REFERENCE TO PELVIMETRY AND FETOMETRY

PAUL C. HODGES, Ph.D., M.D., Chicago, Illinois

A. LOUIS DIPPEL, M.D., F.A.C.S., Baltimore, Maryland

IN 1938 one of us wrote: (46)

"The most important roentgenologic contributions to obstetrics are non-quantitative, require little or no special apparatus, and call for only such experience and knowledge as are possessed by all qualified radiologists. Prominent examples of this group are:

(1) Diagnosis of pregnancy.

(2) Differentiation between single and multiple pregnancy.

(3) Diagnosis of fetal attitude, presentation and position.

(4) Diagnosis of such perversions of pregnancy as ectopic pregnancy, missed abortion, hydatidiform mole.

(5) Demonstration of fetal deformities or disease.

(6) Estimation of amount of amniotic fluid and location of the placenta.

(7) Determination as to whether the fetus is alive or dead.

(8) Thoroughgoing qualitative survey of maternal pelvis."

Advances have continued in most of these non-quantitative phases; for example, Snow and his coworkers (90) and Brown and Dippel (13) have shown that the placenta can be visualized without the aid of opaque media in the amniotic sac or in the urinary bladder.

Division of Roentgenology, University of Chicago.
Department of Obstetrics, Johns Hopkins University and Hospital.

Submitted for publication January 15, 1940.

DEMONSTRATION OF PLACENTA

A single lateral roentgenogram is made with an exposure heavy enough to penetrate the densest parts of the trunk. Unless a wedge-shaped filter is employed, the anterior uterine and abdominal walls may have to be overexposed in order to obtain adequate exposure of the thicker posterior parts, but one compensates for this inequality of exposure by viewing the film with the aid of a strong spotlight, such as a shaded desk lamp equipped with a 150-watt bulb.

It is essential that the roentgenogram be of excellent technical quality but almost any type of apparatus, screens, and films will suffice, and there are innumerable allowable combinations of current, time, and voltage. Dippel and Brown have obtained satisfactory results using a current of 50 ma., an exposure time of four seconds, and a voltage varying from 65 kv. to 85 kv. according to the measured thickness of the patient. In films of this sort (Fig. 1) the uterine wall stands out as a narrow gray stripe silhouetted against the abdominal contents and anterior abdominal wall on the outside, and the fetal panniculus on the inside. At the point of implantation of the placenta this gray stripe widens out into the combined shadow of uterus and placenta. Except in the rare condition of placental calcification, the borderline between the placenta and the uterus is practically invisible, but differentiation is not essential to the diagnosis and one may with confidence interpret as placenta a local widening of

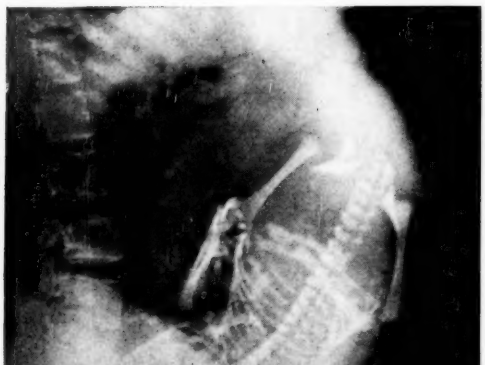


Fig. 1. Demonstration of placenta without the aid of contrast media (Brown and Dippel).

In this case the placenta lies on the posterior wall and the posterior half of the fundus, its presence there being indicated by the wide zone of soft tissue lying between fetal skeleton and external uterine wall.

Direct physical examination is, and perhaps will remain, the only absolutely conclusive means of diagnosing placenta previa, but the technique and dependability of the x-ray diagnosis have seen marked improvement in recent years.

the space between the fetus and the external uterine surface of the sort shown in Figure 1.

In 1898 Karl Holzapfel (50), working at the Frauenklinik of the University of Erlangen, developed a technique for studying the amniotic sac after delivery. The sac, including the placenta, was placed in a tank of water, the torn edge of the membrane being gathered up about the lower plate of a little wooden clamp where it was held securely in place by screw pressure applied through an upper plate. A trocar was now plunged through the placenta and water was injected into the sac until distention was complete.

In 39.2 per cent of 107 amniotic sacs studied by this method, Holzapfel found the placenta located wholly or partly on the anterior wall; in 42 per cent, wholly or partly on the posterior wall; and in only 4.7 per cent, squarely on one of the side walls. In 14 of the remaining 15 cases, implantation was over the end of the fallopian tube, and in only 1, in the lower uterine segment.

Holzapfel's work recently has been confirmed by Torpin (110) who, apparently quite independently in 1938, rediscovered this method of studying placentation. Both workers agree that the placenta usually is implanted over the relatively flat anterior or posterior walls, well above the lower uterine segment, but seldom squarely across the apex of the fundus.

In marginal implantation, most of the placenta shows on either the anterior or the posterior wall, but the upper edge fails to extend into the fundus, while the lower edge extends down into the lower uterine segment. Even in frank lower-segment implantation, more or less of the edge of the placenta usually shows in profile either anteriorly or posteriorly.

In a patient referred because of bleeding in the last trimester of gestation, the lateral roentgenogram, on the one hand, may provide direct evidence that the placenta is normally implanted; or, on the other hand, by a combination of indirect and direct evidence may establish the diagnosis of placenta previa or marginal implantation. Indirectly one infers placenta previa from the absence of a placental shadow in the usual location; directly he supports this inference if he is able to find the edge of a placental shadow extending upward from or downward to the lower uterine segment.

The placenta is most clearly visible at or close to term but it may be seen as early as the twenty-fourth week. The position of the fetus does not affect demonstration of the placenta, but multiple pregnancy makes it difficult or impossible. Obesity complicates the examination; hydramnios constitutes a difficulty as yet insuperable. Regardless of the implantation site, the placenta is seldom if ever seen in frontal roentgenograms.

HISTORY OF PELVIMETRY AND FETOMETRY

The history of this phase of roentgenology may be divided conveniently into three more or less definite periods: the first, from 1895 to 1921; the second, from 1921 to 1931; the third, from 1931 to the present. The first phase saw the invention of practically every type of technique known today but little serious attempt to apply them clinically. The greatly improved pelvic roentgenograms, made possible by Potter's invention of the moving grid in 1921[1], revived interest in obstetrical roentgenology but this interest did not become widespread at once. Moloy and Swenson (65), Orley (74), Hodges and Ledoux (48), and others have reviewed the publications of these two earlier

[1]Potter's first paper was published in 1920 but his grid did not become generally available until 1921.

periods. The onset of the third period is marked by no such specific date as the discovery of x-rays in 1895 or the introduction of the grid in 1921. One can say merely that sometime in the early thirties interest, which had been isolated and in most cases sporadic, became general and sustained.

The importance of x-ray pelvimetry in practical obstetrics is generally recognized today but its greatest usefulness will come only when it has served as the basis for large-scale well controlled studies of pelvic anatomy in living women. We are not in agreement with those who believe that techniques even now are sufficiently standardized but do see in recent advances a promise of stability. Already there is beginning to be agreement as to the particular pelvic dimensions that can be and ought to be measured, and techniques can now be classified into a few fundamental types.

SELECTION OF DIMENSIONS FOR MEASUREMENT

Theoretically it should be possible by means of serial roentgenography to reconstruct working models of the birth canal and fetal head in wax or clay, but the procedure would be so time-consuming and expensive that it is not apt to be developed to a practical stage even for purposes of demonstration or experiment. Eventually it may become clinically feasible to make true scale tracings of the fetal head, the inlet, the outlet, and of one or more intermediate pelvic levels. For the present, however, most workers are content to measure a few of the more significant diameters of the fetal head and maternal pelvis.

DIAMETERS PARALLEL WITH THE CORONAL PLANE

In a frontal pelvic roentgenogram (Fig. 2) it is possible to identify and, by techniques presently to be described, to measure three transverse diameters. The transverse diameter of the inlet (1) has as its end-points the right and left iliopectineal lines at their point of widest separation from one another. The bispinous diameter (2) spans the space between the right and left ischial spines and serves as an index to the width of the midpelvis. The bituberous diameter (3) is the straight-line distance between the inner surfaces of the two ischial tuberosities and is therefore an important guide to the width of the outlet. The rough ischial tuberosities are bounded medially and superiorly by well defined ridges of cortical bone known as the medial lips, which serve as the attachment of the sacrotuberous ligaments. In frontal films these dense ridges appear as short white crescentic lines showing through the more transparent spongiosa of the pubis and the body

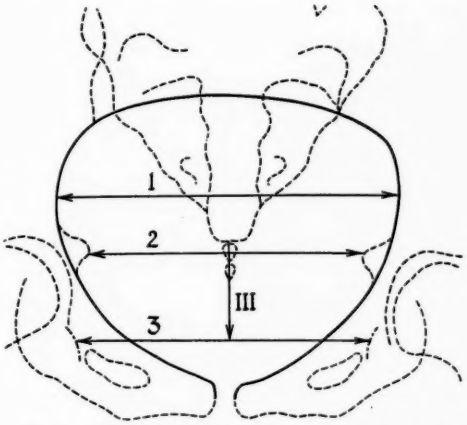


Fig. 2. Frontal view of pelvis. 1. Transverse diameter of inlet. 2. Bispinous diameter of midpelvis. 3. Bituberous diameter of outlet. III. Posterior sagittal of outlet.

of the ischium. The convex surfaces of the crescents are directed inward and their centers are the end-points of the bituberous diameter.

DIAMETERS IN THE SAGITTAL PLANE[1]

The lateral film (Fig. 3) illustrates five significant diameters and can be used for the measurements of at least four of them.

The obstetrical conjugate (I) has an easily identified posterior end-point at the sacral promontory. Its anterior end-point at the most prominent point on the posterior surface of the pubic symphysis is difficult to identify, however, unless the patient is in the true lateral position and the film is of excellent technical quality. It is recognized that the "plane of the inlet" is not a true plane in the mathematical sense, particularly when the obstetrical conjugate is taken as its anteroposterior diameter. For this reason some workers prefer an AP diameter having the same anterior end-point as the obstetrical conjugate but terminating posteriorly on the anterior surface of the sacrum at a point established by projecting backward the iliopectineal lines. Regardless of any theoretical advantages that this new diameter may possess, we are convinced that the obstetrical conjugate is better and that it should be and will be retained. The term "obstetrical conjugate" is thoroughly understood by obstetricians, radiologists, practitioners, and students; the end-points are objective to the roentgenologist, the surgeon, and the anatomist, and it is

[1]In this instance and in all others where we refer to the sagittal plane, we are speaking of the median plane of the body, by some terminologies the midsagittal plane.

established that the magnitude of the dimension is of genuine significance in evaluating the obstetrical adequacy of the pelvic inlet.

The posterior sagittal of the midpelvis (II) has end-points that are definite both anatomically and radiologically. The anterior end-point is at the middle of the bispinous diameter; the posterior end-point, at the anterior-inferior margin of the fourth sacral segment. Measurement of this diameter provides a quantitative estimate of the size of the sciatic notch and therefore of the anteroposterior adequacy of the midpelvis.

The anteroposterior diameter of the midpelvis (IIa) is a dimension easily measured but there is some question as to whether its measurement adds anything to the information supplied by measurement of the posterior sagittal. The posterior end-point is the same as that of the posterior sagittal; the anterior end-point is the inferior-posterior surface of the pubic symphysis.

The posterior sagittal of the outlet (III) has its anterior end-point at the middle of the bituberous diameter, its posterior end-point at the anterior-inferior margin of the body of Sacral 5. While the lateral film (Fig. 3) is used to illustrate this diameter, it cannot be used for measuring it except in those cases in which the crescentic medial lip of the tuberosity can be seen. Usually this lip is seen best in the frontal film and frequently not at all in the lateral.

The pubotuberous distance (IV), which is the distance from the upper surface of the superior ramus of the pubis to the inferior surface of the ischial tuberosity, may be measured manually by a method reported by Schuman (88). It may be measured also in the lateral roentgenogram and however measured serves as an index of the vertical height of the pelvis. A relatively small height makes for obstetrical adequacy; a relatively large height, for inadequacy.

Two other general plans for mapping the sagittal plane deserve consideration but in our opinion are not as satisfactory as the plan described. Caldwell and his group (19) employ the plan illustrated in Figure 4. The AP diameter of the Inlet I is established by projecting forward from the iliopectineal lines to the curved posterior surface of the pubic symphysis and backward through a dense white line cast by the posterior parts of the ilium to a point on the anterior surface of the sacrum. Diameter IV, constructed perpendicular to I and passing through the ischial spines, is a gauge of the vertical height of the pelvis. Diameter II, parallel with I, perpendicular to IV, and passing from the ischial spines back to the sacrum, is the posterior sagittal of the midpelvis. Diameter III, parallel with I and II and perpendicular to IV, arising at the inferior surface of the ischial tuberosity and extending back to the sacrum, is the posterior sagittal of the outlet. It is recognized that the site selected for the construction of I will influence, sometimes profoundly, the values of the other measurements, but proponents of the plan are confident of their ability to establish the plane of the inlet in all cases. Experience may show that this method of work-up is sound but, because it ignores the obstetrical conjugate and because the absolute values of the posterior sagittals are so vitally dependent upon the exact site selected as the plane of the inlet, we prefer for the present at least to employ the older plan.

In Ball's (5) plan (Fig. 5) the obstetrical conjugate I is the conventional diameter based on the sacral promontory behind, the most prominent point on the posterior surface of the pubic symphysis in front. The other two AP diameters have the same anterior end-point, but the posterior end-point for II is the middle of the third sacral segment; that for III, the inferior margin of the fifth segment.

Ball uses the designation D for Diameter II and calls it "the distance from the pubic symphysis to the most concave portion of the sacrum," but in all of his illustrations its posterior termination is the middle of Segment 3. We refer to II as Ball's AP diameter of the midpelvis because it is the middle one of his AP pelvic diameters, but usually, as in the case illustrated in our Figure 5, it lies above the ischial spine which is the most important obstetrical landmark of the midpelvis.

Ball uses the designation A for III and calls it "the anteroposterior diameter of the pelvis about the level of the bi-ischial spines," but his illustrations invariably show its posterior termination at the inferior margin of the fifth sacral segment, which also is the lower end of his Diameter IV. In the case illustrated in our Figure 5, III lies about as far below the ischial spine as II lies above. We speak of III as Ball's AP diameter of the outlet because it is the lowest of his three AP diameters, but it fails to pass through that cardinal point in the pelvic outlet, the ischial tuberosity.

Diameter IV, which Ball designates C and describes as the height of the sacrum, in reality is a chord of the arc described by the sacrum. Its upper end lies at the sacral promontory, its lower end at the inferior margin of the fifth sacral segment. The absolute value of IV is of little significance. For instance, an adequate pelvis may show a short IV because the sacrum is short and incidentally is directed backward, which leaves ample

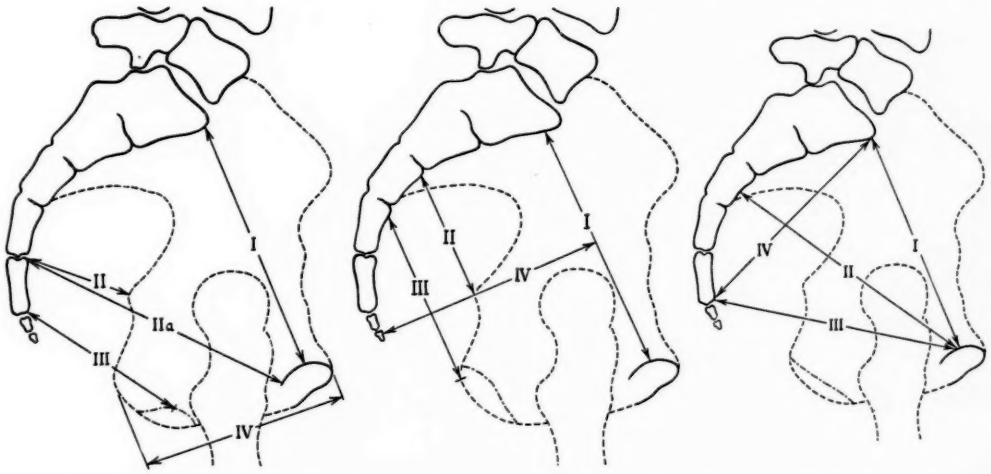


Fig. 3. Lateral view of pelvis. I. Obstetrical conjugate. II. Posterior sagittal of midpelvis. II-a. A. P. diameter of midpelvis. III. Posterior sagittal of outlet. IV. Pubotuberous distance.

Structures shown in solid lines lie in the sagittal plane and therefore can be shown in true proportion in orthograms made from the lateral film. It is possible to project the ischial spines orthometrically onto the sagittal plane.

There is great variability in the size, shape, and location of the medial lips of the ischial tuberosity which are the end-points of the transverse diameter of the outlet and thus the determining factors in the posterior sagittal of the outlet. By present techniques these lips seldom are discernible in lateral films. The lip is sketched in here to show one of the positions in which it might lie if it could be seen.

The posterior sagittal of the outlet (III) though shown in this diagram cannot be measured in the lateral film because of the inability to see the medial lip of the tuberosity. It can be measured in stereoscopic frontal films (see Fig. 2).

Fig. 4. Sagittal-plane diameters as measured by Caldwell's group. I. A. P. diameter of plane of inlet. II. Posterior sagittal of midpelvis. III. Posterior sagittal of outlet. IV. Perpendicular dropped from plane of inlet at intersection of A. P. and transverse diameters.

Another type of medial lip of ischial tuberosity is illustrated here. See also Figures 3 and 5.

Fig. 5. Sagittal-plane diameters as measured by Ball. I. Obstetrical conjugate. II. A. P. diameter of midpelvis. III. A. P. diameter of outlet. IV. Height of sacrum.

As in Figures 3 and 4, so here the medial lip of the ischial tuberosity has been sketched in to show another of the many types that may be encountered.

room at the outlet, whereas an inadequate pelvis in which a long sacrum curves sharply forward to encroach on the outlet may show a Diameter IV of identical magnitude.

Ball's plan is attractive to radiologists because his end-points for the most part are definite anatomical structures, but in our opinion the failure to base II and III on the ischial spines and the ischial tuberosities, respectively, together with the faults of IV described above, constitute obstetrical shortcomings that outweigh the technical advantages.

DIVERGENT DISTORTION

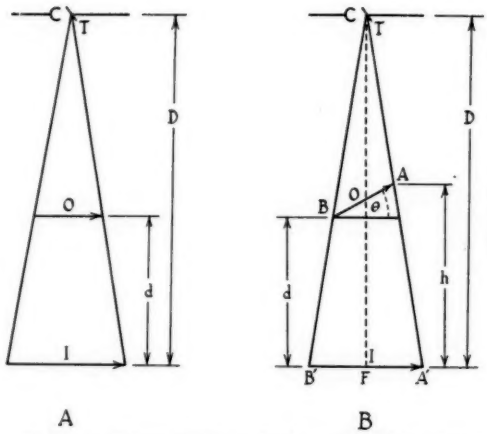
X-rays diverge from their point of origin on the target of an x-ray tube and images produced by them invariably suffer divergent distortion (Fig. 6-A). The amount of this distortion is least when the target-film distance (D) is great and the object-film distance (d) small, but under all practical working conditions the amount of this type of distortion occurring in pelvic roentgenograms is considerable. The true value of an object (O), such as the obstetrical conjugate, may be computed by measuring its image (I) as seen in the lateral film and substituting in:

$$\text{Equation No. 1: } O = I\,\frac{D-d}{D}$$

in which O is the true diameter of an object; I, the diameter of its x-ray shadow; D, the target-film distance; and d, the object-film distance. The idea that the use of a sufficiently great target-film distance will obviate the necessity of correction is fallacious even in the case of pelvic dimensions parallel with the film, to say nothing of those that are oblique to the film.

OBLIQUE DISTORTION

When the object is parallel with the film the only distortion is divergent distortion, but when it is oblique (Fig. 6-B) one must deal with oblique



A B

Fig. 6. A. Divergent distortion in case of object lying parallel with plane of x-ray film. T = Target of x-ray tube. D = Target-film distance. O = Object. I = Image. d = Object-film distance.

B. Combined divergent and oblique distortion in the case of an object oblique to the plane of the film. A = Upper end of oblique object. B = Lower end of oblique object. Θ = Angle between object and plane of film. A′ = Image of A. B′ = Image of B. d = Height of B above film. h = Height of A above film. F = Footpoint of perpendicular dropped from T to plane of film.

distortion as well. In such a case, divergent distortion tends to lengthen the image and oblique distortion to shorten it, the result being an algebraic sum of the two effects.[1]

Under these conditions the computation of the length of O involves more complicated equations. If the angle of obliquity (Θ) is known, the equation is:

Equation No. 10: $O = \frac{h-d}{\text{Sin } \Theta}$

in which h is the height above the film of the upper end of an oblique object; d, the height above the film of the lower end of an oblique object; and Θ, the angle of obliquity. When this angle is unknown, theoretically the following equation might be employed:

Equation No. 11:

$$O = \sqrt{(h-d)^2 + \frac{1}{D^2}[I(D-d) - A^1F(h-d)]^2}$$

For the meanings of the literal terms, see Figure 6-B. This equation itself is too cumbersome for direct use in x-ray pelvimetry but there are numerous means of applying it with little or no direct mathematical effort.

[1] In the case illustrated, oblique distortion acts in the direction of foreshortening the image. Foreshortening is a common but none the less special case of oblique distortion. In those cases in which both object and radiation are oblique to the film, oblique distortion may produce a lengthening rather than a foreshortening of the image.

GENERAL PRINCIPLES OF TECHNIQUE OF X-RAY PELVIMETRY

While the number of techniques that have been suggested for x-ray pelvimetry is astonishingly large, it will be found on inspection that most of these techniques fall into four general divisions with only a few subtypes in each division (Table I).

TABLE I

I. Position methods
  - A. Isometric scales
  - B. Proportional scales
  - C. Triangular proportion
    1. Direct application of equations
    2. Graphs of equations
    3. Slide rules

II. Parallax methods
  - A. Stereoscopic
    1. Direct parallax
    2. Measurement of virtual image
    3. Geometric construction
      a. Plane
      b. Solid
  - B. Non-stereoscopic
    1. Single film
    2. Multiple films
      a. Cartesian co-ordinates

III. 90-Degree triangulation
  - A. Empirical
  - B. Geometric construction
    1. Plane
    2. Cartesian co-ordinates

IV. Orthometric reproduction
  - A. Pantographic
  - B. Orthoscopic
  - C. Geometric

Of the papers reviewed by us, those mentioned by name in the pages that follow have been selected not because of merit or lack of merit, but simply as convenient illustrations of this or that particular method. The numerous references to isometric scales used in connection with the lateral film are justified, we believe, on the score of the practical importance of this development, the rapidity with which it has occurred, and the satisfactory stage to which it has progressed.

Solution by Cartesian co-ordinates, though of little practical value, is described in detail because the theory is important and papers dealing with it are not readily available to clinical workers. On the other hand, we have omitted the details of certain clinically important techniques, such as those employing the stereoroentgenometer and the measuring stereoscope, because complete descriptions of these techniques would require

much space and have been published elsewhere recently (45) (18).

I. POSITION METHODS

The patient is arranged on the x-ray table in a position calculated to place the part being examined in a known relationship to the film. One of the most popular examples is Thoms' (95) measurement of the pelvic inlet from a film made with the patient in the semi-recumbent position on the questionable assumption that the plane of the inlet coincides with a plane extending from an anterior end-point 1 cm. below the superior surface of the pubic symphysis to a posterior end-point midway between the spinous processes of the fourth and fifth lumbar vertebræ. Another example is the measurement of the obstetrical conjugate from a lateral roentgenogram on the sound assumption that the plane of the conjugate coincides with the sagittal plane of the body. Most workers have the patient lie on her side on the film but some have her stand with her side against the film (107), and others have her lie on her back with the film supported against her side (118) (24).

I–A. ISOMETRIC SCALES

These are radiopaque rulers located in the supposed plane of the part being examined. Since the x-ray image of such a ruler and the x-ray image of the anatomical part suffer identical distortion, the ruler image may be used to measure the part. If the ruler is marked off at 1-cm. intervals, the examiner calipers the image of the part, places the calipers on the image of the scale, and reads off the true diameter of the part without computations of any sort. For reasons that are not obvious, some workers employ a ruler with only two marks on it and compute the diameter of the part from the equation:

$$\text{Equation No. 5: } O = I\,\frac{M}{Y}$$

in which O is the diameter of the anatomical part; I, the diameter of the x-ray image of the part; M, the length between the points on the ruler; and Y, the length between the points on the image of the ruler. Thoms' perforated lead plate for the inlet view and his calibrated rod for the lateral view are isometric scales.

TORPIN'S APPARATUS FOR EMPLOYING THOMS' ISOMETRIC SCALE WITH THE INLET VIEW

Torpin, Holmes, and Hamilton (112) have devised an apparatus consisting of a thin wooden base plate on which are mounted an inclined back rest and two support posts, the latter free to move in longitudinal slots. Each post carries an adjustable arm, at the end of which there is a small transverse metal bar. The apparatus is placed on a flat-topped x-ray exposing table with the film in a Potter grid beneath, the x-ray tube perpendicularly above. After adhesive plaster has been attached to the patient's skin to identify the anterior end-point (1 cm. below the upper surface of the pubic symphysis) and the posterior end-point (at the space between the spinous processes of the fourth and fifth lumbar vertebræ), the patient is seated on the board and made to lean back against the back rest. The anterior support post is now moved inward to the end of its travel and its arm adjusted until the bar rests against the anterior skin mark. In the same fashion, the arm on the posterior support post is adjusted until its bar rests against the posterior skin mark. With the arms locked in this position, the film is made, following which the support posts are moved back to the outer limit of their travel so that the patient may get off the table. Care is taken, of course, to assure that the relative positions of the x-ray tube, base plate, and film remain fixed throughout the examination. After the patient has left the table, the posts are moved in again to the limit of their travel, which brings the bars of the adjustable arms back to the position occupied by them during the making of the film. Thoms' perforated plate is now placed on the bars of the adjustable arms and a final short exposure is made to superimpose the images of the perforations on the image of the pelvis.

Like all methods employing isometric scales, Torpin's method does not require knowledge of the magnitude of D or *e*. Its advantage over Thoms' original technique lies in the simplicity and accuracy with which the plate may be brought into the plane of the anterior and posterior skin marks. Like all position methods, however, it has the inherent weakness that the *d* and Θ of the part being examined (in this case the pelvic inlet) are not obtained from the films themselves but must be determined by measurements on the patient.

ISOMETRIC SCALES USED IN CONNECTION WITH THE LATERAL PELVIC FILM

Granzow (37) was one of the first to use an isometric scale in connection with the lateral film. His scale is a metal ruler calibrated in centimeters, which is attached with adhesive plaster to the skin in the midline over the sacrum. Measurement of the obstetrical conjugate is accomplished by calipering the x-ray image of the conjugate

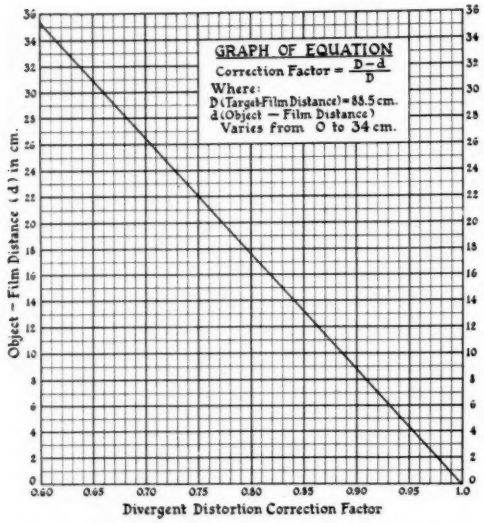


Fig. 7. Graph of correction factor for divergent distortion in the case of objects parallel with the plane of the film.

and then laying the calipers on the image of the scale. The isometric scales of Thoms (107), Weitzner (121), Naendrup (69), and Madsen (63) are essentially the same as that of Granzow. Thoms' scale is a long, calibrated metal rod mounted in a heavy movable base. The patient stands with her side against the film and the base is moved about on the floor until the rod lies in the gluteal fold. Weitzner employs a 10-in. length of ¾-in. brass pipe threaded with eight threads to the inch and attached with adhesive plaster to the skin in the midline over the sacrum. Calipers set on the image of the obstetrical conjugate and then carried to the image of the pipe show the true value of the conjugate in eighths of inches. Naendrup uses a sterilizable rod of transparent plastic with opaque calibrations at ½-cm. intervals. This rod is inserted into the patient's rectum and in the completed film sagittal-plane objects are measured by setting calipers upon the x-ray images and then laying the calipers on the image of the rod. Madsen attaches a calibrated metal ruler to the skin in the midline over the sacrum and like the others might accomplish measurements of sagittal-plane objects by setting calipers on their images and then laying the calipers on the image of his scale. However, for some reason that is not clear to us, he prefers a rather complicated geometric construction based on similar triangles that include the image of the scale and the image of the obstetrical conjugate.

Bayer (6) and Berg (7) use a metal scale of known length attached to the tube-stand so that it is readily adjustable for vertical and transverse movement but remains parallel with the plane of the film and, having been adjusted, can be locked in position. The patient lies on her side on the x-ray table, the scale being inserted into the gluteal fold and pressed against the pubic symphysis and the coccyx. Lambert and Grunberg (61) use an opaque scale of known length which they insert between the lips of the vulva. Since in both cases the scales are uncalibrated, it is not possible to employ the rapid, simple device of calipering the x-ray image of a midline object and then laying the calipers upon the x-ray image of the scale. Instead, the measured length of the x-ray image of the sagittal-plane object must be corrected either by means of a graph or by direct substitution in Equation No. 5 (see p. 427).

I-B. PROPORTIONAL SCALES

These are radiopaque rulers, located at a known position relative to target, part, and film but not in the plane of the part. The surface marker for measurement of the obstetrical conjugate from the lateral film, described by one of us, is a proportional scale (47).

I-C-1. TRIANGULAR PROPORTION DIRECT APPLICATION OF EQUATIONS

It is possible to apply position methods without special scales or any other special apparatus provided target-film distance (D) and object-film distance (d) are known. One measures the image of the anatomical part (I) and computes the actual diameter of the part (O) by substituting in the equation:

$$\text{Equation No. 1: } O = I\,\frac{D-d}{D}$$

I-C-2. GRAPHS OF EQUATIONS

If the target-film distance is fixed, the correction factor $\frac{D-d}{D}$ may be graphed for any desired range of d (Fig. 7). Knowing object-film distance, one obtains from such a graph a correction factor, which multiplied by the diameter of the image yields the true diameter of the object.

The false centimeter scale which Walton (118) constructed empirically can be reproduced by graphing the correction factor $\frac{D}{D-d}$ from the equation:

$$\text{Equation No. 2: } I = O\,\frac{D}{D-d} \qquad \text{(Fig. 8)}$$

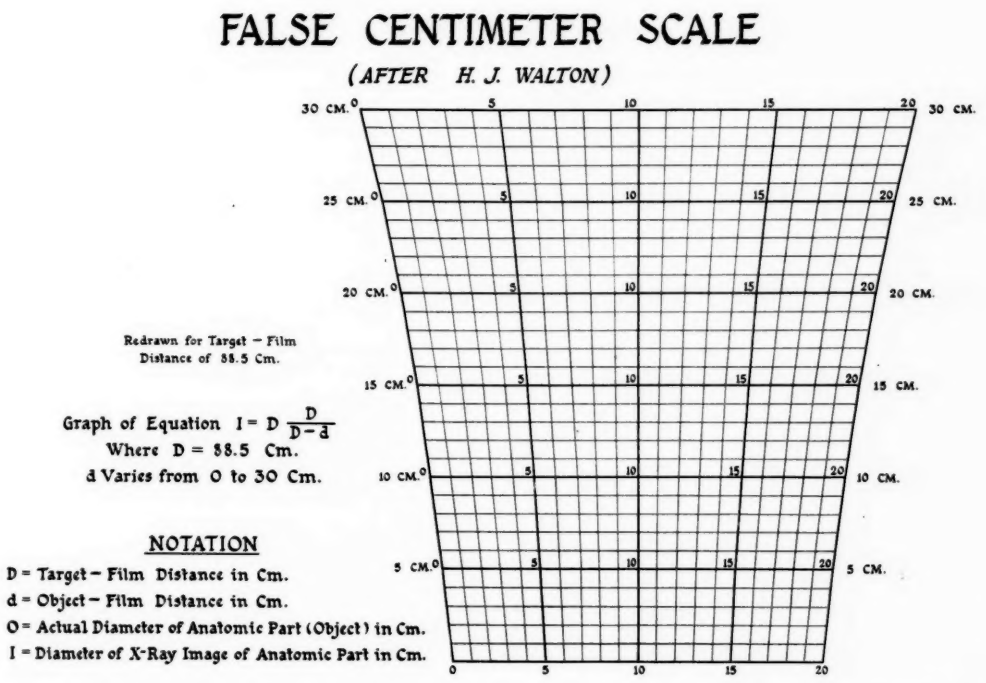

FALSE CENTIMETER SCALE
(AFTER H. J. WALTON)
30 CM.
25 CM.
20 CM.
15 CM.
10 CM.
5 CM.
0
5
10
15
20
Redrawn for Target – Film Distance of 88.5 Cm.
Graph of Equation I = D D/(D-d)
Where D = 88.5 Cm.
d Varies from 0 to 30 Cm.
NOTATION
D = Target – Film Distance in Cm.
d = Object – Film Distance in Cm.
O = Actual Diameter of Anatomic Part (Object) in Cm.
I = Diameter of X-Ray Image of Anatomic Part in Cm.

Fig. 8. Walton's false centimeter scale. Showing directions for Construction and Use of Walton's False Centimeter Scale.

Use standard cross-section millimeter graph paper (Keuffel and Esser 300, measuring 40 cm. by 50 cm. is a convenient size). Near the bottom of the sheet draw a horizontal base line and at its center erect a 30-cm. perpendicular. Lay off on the base line at 1-cm. intervals ten points to the left, ten to the right of the perpendicular, numbering them 0 to 20 from left to right with 10 at the central perpendicular.

Draw six horizontal lines parallel with the base line at 5-cm. intervals above it, numbering them from 0 to 30, beginning with the base.

Solve the correction factor $\frac{D}{D-d}$ for a d of 5 and a D equal to the particular target-film distance (in cm.) of your own apparatus. Multiply the factor thus obtained by 10 to obtain the image diameter of a 10-cm. object located 5 cm. above the film and mark points on the 5 cm. horizontal at this distance to the left and to the right of the central perpendicular. Repeat the process for objects of 9 cm., 8 cm., etc., down to 1 cm. so that 20 points are marked on the 5 cm. horizontal, 10 at either side of the central perpendicular. Number these points 0 to 20 from left to right, with No. 10 at the central perpendicular.

Continue this process until 20 points have been established on each horizontal and then draw 20 curves, each one connecting corresponding points on the base line and the 6 horizontals.

The 20 curves and the central perpendicular cut the base line at intervals of exactly 1 cm. but at the other horizontals the intervals are greater than 1 cm. Above the base line, therefore, the centimeter and millimeter ruling must be ignored and the horizontal lines looked upon as scale rules on which centimeters are indicated by the intersecting curves and perpendicular.

To use Walton's false centimeter scale for the determination of the actual diameter of an object from a measurement of its distorted roentgenographic image, set calipers on the image and then place them on the scale at the horizontal corresponding to the supposed height of the object above the film. With one caliper leg resting on the zero curve, the other leg will indicate in scale cm. the actual diameter of the object.

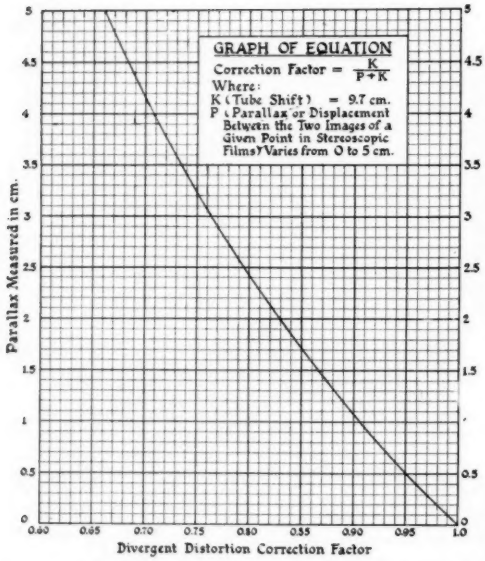

GRAPH OF EQUATION
Correction Factor = K/(P+K)
Where:
K (Tube Shift) = 9.7 cm.
P (Parallax or Displacement Between the Two Images of a Given Point in Stereoscopic Films) Varies from 0 to 5 cm.
Parallax Measured in cm.
Divergent Distortion Correction Factor

Fig. 9. Graph for obtaining divergent distortion correction factor from stereoroentgenograms by means of measured parallax.

Such a graph appeals to many because it obviates even such simple arithmetic as multiplying by a two-place or three-place decimal, but since the smallest scale divisions are centimeters and since fractions of centimeters must be estimated, measurements made with this chart are probably somewhat less accurate than those made with the aid of a correction factor graph (Fig. 7) or Ball's calculator (Fig. 10).

I-C-3. SLIDE RULES

Ball (5) and Holmquest (49) have designed a calculator something like a slide rule by means of which the diameter of the object may be read off directly, provided I, D, and *d* are known (Fig. 10). Like Walton's chart, its use obviates computations and, in addition, D is variable over a wide range.

II-A-1. STEREOSCOPIC PARALLAX METHODS DIRECT PARALLAX

Unlike position methods, parallax methods require no assumptions as to the location of the anatomical part relative to surface landmarks, rulers, film, or x-ray tube. Two exposures are made, the tube being shifted a measured distance (K) between exposures. Rarely the two exposures are made on a single film, more frequently upon two separate films provided with suitable register marks so that after they have been studied and measured independently they may be superimposed for measurement of the amount of displacement or parallax between the images of the part being measured. The usual practice is to employ a tube shift suitable for stereoscopy because stereoscopic vision is of great help in identifying the end-points of the images preliminary to measurement of parallax. If the part is parallel with the film the magnitude of this parallax depends upon tube shift (K), the object-film distance (d), and the target-film distance (D), the relationship being expressed by:

$$\text{Equation No. 7: } P = \frac{Kd}{D-d}$$

Rearranging equation No. 7, one obtains:

$$\text{Equation No. 8: } d = \frac{PD}{P+K}$$

Equation No. 8 is the algebraic way of saying that if one works with a fixed target-film distance (D) and a fixed tube shift (K), he needs no marker or surface landmark to tell him the object-film distance (d) because he can compute it by measuring parallax. Furthermore, by substituting the expression $\frac{PD}{P+K}$ for the value of *d* in equation No. 1, D cancels out and we obtain:

$$\text{Equation No. 9: } O = I\frac{K}{P+K}$$

In equation No. 9, the expression $\frac{K}{P+K}$ is the parallax correction factor which may be expressed as a graph (Fig. 9). Figure 11 illustrates the direct parallax method of measuring the occipitofrontal diameter of the skull of an unborn fetus. The method is applicable to the measurement of any maternal or fetal part that lies parallel with the plane of the film.

II-A-2. MEASUREMENT OF VIRTUAL IMAGE

When the anatomical part and film are not parallel, one may view the stereoroentgenograms in a measuring stereoscope equipped with semitransparent mirrors and measure the virtual image with a real ruler of some sort. In the instrument used by Caldwell's group (18), the ruler is an opaque flood-lighted metric scale; in Westergaard's (122) a movable, luminous point is employed.

Workers who dislike mathematics are attracted by the apparent simplicity of this method, but the apparatus is costly and the simplicity of its

use more apparent than real. Careful workers equipped with better-than-average stereoscopic vision apparently learn to make measurements with reasonable accuracy, but in our opinion the method is subjective and, in all but the most careful hands, inaccurate.

II-A-3-a. PLANE GEOMETRIC CONSTRUCTION

Plane geometric construction in many respects is the simplest and most accurate means of dealing with objects lying oblique to the film. Chamberlain and Newell (22), Hodges and Ledoux (48), and Friedman and Euphrat (34) have described methods differing in detail but identical in general principle. By various means (described in detail in the original publications), one identifies certain points on both films and makes certain constructions either on the superimposed films themselves or on a tracing of them. The points that must be identified are the following: (1) two target foot points, T_1 and T_2 (these are the foot points of perpendiculars dropped from the two positions of the target of the x-ray tube to the plane of the film); (2) two shadow points, A_1 and A_2 (these are the two images of the upper end of an object (O) lying oblique to the plane of the film, A_1 being the image made with the tube above T_1 and A_2 the image made with the tube above T_2 [see Fig. 6-B]); (3) two shadow points B_1 and B_2 (these are the two images of the lower end of the object [see Fig. 6-B]); and (4) two object foot points, A_3 and B_3 (these are the foot points of perpendiculars dropped from the two ends of the object (O) to the plane of the film; A_3 lies at the crossing of straight lines drawn from T_1 to A_1 and from T_2 to A_2; B_3 lies at the crossing of similar lines involving B_1 and B_2). Usually A_3 and B_3 can be located by construction, but when this is impossible, the location of A_3 may be determined by substituting in equation No. 12:

Equation No. 12: $X=\frac{dY}{D}$

in which Y is the length of a straight line connecting A_1 and T_1; X, the distance from A_1 to A_3 measured along this line; while d and D have the usual meanings. B_3 is found by similar means, and after both points have been located, a base line is drawn connecting them.

The distance between A_1 and A_2 is the parallax (P) for A; that between B_1 and B_2 the parallax for B. Hodges and Ledoux calculate object-film distance *d* for A and B by tables or graphs of:

Equation No. 8: $d=\frac{PD}{P+K}$

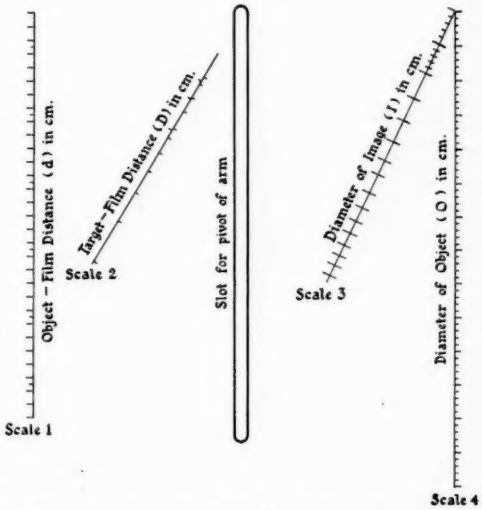

Object – Film Distance (d) in cm.
Scale 1
Target – Film Distance (D) in cm.
Scale 2
Slot for pivot of arm
Diameter of Image (I) in cm.
Scale 3
Diameter of Object (O) in cm.
Scale 4

Fig. 10. Diagram of Ball and Holmquest's nomographic calculator for correction of divergent distortion in objects parallel with the plane of the film.[1]

To simplify the diagram, the arm or straightedge is not shown. This arm swivels on a pivot which can be located at any desired point in the central slot.

To use the instrument, the arm is manipulated until its central line cuts object-film distance on Scale 1, target-film distance on Scale 2. The knob on the pivot of the arm is now tightened, fixing the pivot in the vertical slot. When this has been done, the arm is swung across to the right and manipulated until its central line cuts Scale 3 at a point corresponding to the measured length of the x-ray image of the object under consideration. The actual length of the object may now be read off on Scale 4 at the intersection of this scale with the central line of the arm.

in which P is the displacement or parallax between the two images of an object; K, the tube shift; while D and d have their usual meanings. Chamberlain and Newell read off *d* directly by measuring the parallax with a special scale ruler in which each scale centimeter has an actual length of:

Equation No. 13: $\frac{1+K}{D}$ centimeters

When the *d*'s for A and B have been computed, a line is erected at A_3 perpendicular to the base line A_3B_3 and with a height equal to the difference between the *d* for A and the *d* for B. Finally a hypotenuse is drawn from the upper end of this perpendicular to the point B_3, the length of this hypotenuse being the true length of the object (O) and the angle between the hypotenuse and the base line being the angle of its obliquity (Θ).

[1]Manufactured by the General Electric X-ray Corporation, Chicago, Illinois.

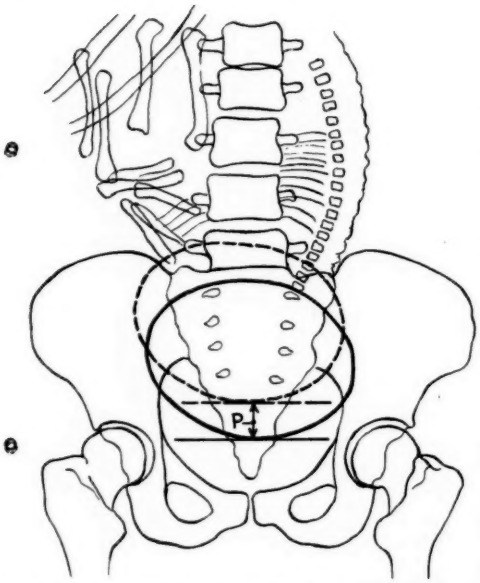


Fig. 11. Cephalometry by the direct parallax method. Wax pencil lines are drawn tangent to the vertex of the skull and perpendicular to the stereoscopic axis in one of a pair of stereoroentgenograms (solid lines) and then in the other (dotted lines), following which the roentgenograms are superimposed with their register marks coinciding. The distance in centimeters between the two tangents is the parallax (P) of the vertex. Laying this value off on the graph of the correction factor from equation No. 9 (Fig. 9), one obtains a factor for the correction of triangular distortion of all diameters lying in the plane of the vertex. The product of gross occipitofrontal diameter multiplied by this correction factor is the net or true occipitofrontal diameter. Direct parallax is applicable to the measurement of any maternal or fetal part that lies parallel with the plane of the film.

Christensen (*23*) has published a two-film parallax method with work-up by plane geometric construction but with tube shift (K) perpendicular to the plane of the film rather than parallel with it. He describes his method as "stereometric," but it is not stereoscopic in the sense that the films can be viewed stereoscopically.

The first exposure is made with a target-film distance (D) of any convenient known amount, the second exposure with a D double the first one. In a tracing made from the superimposed films there are, of course, two images of the object. For convenience in the description that follows, we shall designate the larger image made with the shorter D as I, the smaller image made with the longer D as *i*, and as far as possible we shall use for the other values not the symbols published by Christensen but rather those that we have used in describing other papers.

Case I, Parallel Objects. When the object lies parallel with the film, the two images I and *i* will be parallel with one another. In such cases the true length of the object (O) is found by quite simple construction. An upper "converging line" is drawn from the upper end of I through the upper end of *i* and is continued on across the tracing. A lower converging line connects the lower ends of I and *i* and is extended until it crosses the upper converging line at the point X.

The center of *i* is located and "two real diagonals" are drawn through it, one beginning at the upper end of I and ending on the lower converging line at the point *l*, the other beginning at the lower end of I and ending on the upper converging line at the point *u*. The measured distance between *u* and *l* is the length O, which is being sought.

Case II, Oblique Objects. When the object is oblique relative to the plane of the film, its two images I and *i* are not parallel with one another. Upper and lower converging lines are drawn as in Case I, and two "provisional diagonals" are drawn, the first from the upper end of I to the lower end of *i*, the second from the lower end of I to the upper end of *i*. From the point of intersection (N) of these provisional diagonals, to the point X, one draws a straight line NX.

Point M is the intersection of NX with *i*. Through the point M, two real diagonals are drawn, one beginning at the upper end of I and terminating in point *l* on the lower converging line, the other beginning at the lower end of I and terminating at *u* on the upper converging line. Line P is now drawn beginning at *l* and lying parallel with I. This represents not O but rather the projection of O onto the plane of the film. Note that P cuts the upper converging line at the distance *a* from *u*. The value sought (length of the object, O) is the hypotenuse of a right triangle in which the altitude is *a* and the base is the difference between the height of the upper end of O (*h*) and the height of its lower end (*d*).

Christensen obtains $h-d$ by construction. An angle of any convenient magnitude is drawn and its sides are extended indefinitely. From the vertex, one measures down along the right side of the angle for a distance equal to some convenient fraction of IX (for instance, 1/10 of this value) and makes a mark Q. Continuing along the same side of the angle with Q as a starting point, he lays off one-tenth of the shorter target-film distance (D) and thus locates a second point (*r*). Beginning at the apex and measuring along the left side of

the angle, he lays off the measured length of *a* and establishes a third point (*s*). A line is now drawn beginning at the right side of the angle at *r* and extending parallel to the line Q*s* to cut the left side of the angle at the point *t*. The segment (*st*) of the left side of the angle is the value $h-d$ which is being sought.

The value $h-d$ may be obtained also from equation No. 25.

Equation No. 25: $\frac{IX}{D}=\frac{a}{h-d}$

in which IX is the measured distance from the upper end of the larger image to the crossing of the converging lines; a, the measured distance from *u* to the line P measured along the upper converging line; D, the shorter of the two target-film distances; h, the height above the film of the upper end of an oblique object; and d, the height above the film of the lower end of an oblique object.

It is our opinion that Christensen's method has no advantages over the older methods of geometric construction in which the tube shift is parallel with the film. On the other hand, it does have three obvious disadvantages: (1) commercial x-ray exposing tables do not lend themselves readily to a change of target-film distance (D) from the normal value to double the normal value; (2) the useful procedure of preliminary stereoscopic viewing of the films for the identification of shadow points is rendered impossible by Christensen's type of tube shift; and (3) the constructions and computations are more complicated than those required by the other methods and yet apparently yield no more accurate results.

II-A-3-b. SOLID GEOMETRIC CONSTRUCTION

Solid geometric construction is accomplished by means of a cross-thread instrument introduced by Davidson (29), named the stereoroentgenometer by Johnson (55), and used by many other workers including Clifford (25), Judson (56), Dippel (31), and Hodges (45). For the measurement of oblique objects the stereoroentgenometer is simpler and faster, but in our opinion somewhat less accurate than plane geometric construction.

II-B-1. NON-STEREOSCOPIC SINGLE-FILM PARALLAX METHODS

Fray and Pommerenke (33), impressed with the difficulty of registering stereoroentgenograms controlling D and K and preventing movement of the patient between exposures, use two tubes and make the two exposures simultaneously on a single film. A somewhat similar approach has been successful in the past for the localization of metallic foreign bodies, particularly in war wounds, a situation in which the end-points usually are so well defined that they can be made out in spite of the fogging of the image inevitable in a double exposure. In pelvimetry and fetometry, however, the end-points may be difficult to recognize even with the best technique and we believe that the difficulty of identifying parts in double-exposed films, together with the sacrifice of stereoscopic vision, will be found to more than offset the advantages of economy, simplicity, and elimination of movement that are offered by this method.

F. A. Wahl (117) describes a single-film parallax method that employs a special masking grid somewhat like the one described by Thomas (94) for the measurement of diaphragmatic excursion. Wahl's masking grid consists of eight metal strips 2½ cm. wide, separated by transparent strips of the same width. With the target over T_1, the first exposure is made, following which the grid is moved until the exposed portions of the film are protected; the unexposed portions are uncovered. The tube is now shifted to a point above T_2 and the second exposure is made. The only advantages of this method are economy and obviation of the necessity of registering films, and to us these seem to be completely outweighed by the sacrifice of stereoscopic vision and the probability that anatomical parts essential to measurement may be lacking in the segments making up the right-eye image, or in those making up the left-eye image, or even in both.

II-B-2. NON-STEREOSCOPIC MULTIPLE-FILM METHODS

At the other extreme from the single-film parallax methods described is the suggestion of Portes, Mayer, and Mathieu (78) that four films be used. For details see their publication.

II-B-2-a. SOLUTION BY CARTESIAN CO-ORDINATES

The distance between any two points A and B, for example, the end-points of the obstetrical conjugate, is readily determined by analytic geometry provided the three-dimensional space or the Cartesian co-ordinates (*x*, *y*, *z*) of both points are known. The relation between the length of the line and the co-ordinates is expressed in:

Equation No. 15: $L=\sqrt{\Delta x^2+\Delta y^2+\Delta z^2}$

in which L is length of a line AB; Δx, the *x* co-ordinate of A (written x_A) minus the *x* co-ordinate of B (written x_B); Δy, the *y* co-ordinate of A (written y_A) minus the *y* co-ordinate of B (written y_B); Δz, the *z* co-ordinate of A (written z_A) minus the *z* co-ordinate of B (written z_B).

In the method of Hodges and Ledoux (II-A-3), after A_3 and B_3 have been located and the *d*'s of A and B determined, it is possible to complete the solution by analytical geometry rather than by construction. Three axes of reference must be provided, a convenient arrangement being to represent the *x* axis as a horizontal line passing through B_3, the *y* axis as a second line perpendicular to the *x* axis and also passing through B_3, and the *z* axis as an imaginary line perpendicular to the plane of the film at the point B_3.

In a frame of reference of this sort, x_A is the perpendicular distance from A_3 to the *y* axis, y_A the perpendicular distance from A_3 to the *x* axis, z_A the *d* of A. x_B is zero, y_B is zero, and z_B is the *d* of B.

On theoretical grounds, a mathematician might choose solution by co-ordinates in preference to solution by construction, but under practical working conditions, construction is the more rapid and probably the more accurate method.

Hummel and Hume (52) have described a two-film non-stereoscopic parallax method in which two special scales are photographed onto the films and solution is by means of Cartesian co-ordinates. The examination can be conducted on any ordinary, flat-topped x-ray table provided with a Potter grid. Tabletop-film distance (*e*), target-film distance (D), and tube shift (K) need not be known. One of the scales lies beneath the patient, the other above her. Both are cross-shaped, the vertical limb of the cross serving as the *y* axis, the transverse limb as the *x* axis. The transverse and longitudinal limbs of the upper scale lie perpendicularly above and at a known distance above the corresponding limbs of the lower scale, the centers of the two scales being slightly offset relative to the center of the film. It is convenient to rule the lower scale in one manner (for instance, with opaque points) and the other scale in a different manner (for instance, with opaque lines) so that their images may be distinguished from one another readily.

The first exposure is made with the tube centered at approximately the center of the film. Following this, the second film is placed in the grid tray and the tube is shifted either longitudinally or transversely, the exact amount of the shift being unimportant. As published by these authors, stereoscopy is not employed, but it would be preferable to use a shift suitable for stereoscopy so that stereoscopic vision might be employed for the subsequent identification of shadow points. It is essential that the patient's position relative to the upper and lower scales remain fixed during the making of the two films.

For convenience in the description that follows, we have employed notations of our own, believing that they will be more easily understood than the notations used by the authors. The meanings of our notations are as follows:

A = the end-point of some pelvic diameter; for example, right ischial spine

B = the other end-point of the bispinous diameter, that is, the left ischial spine

$\overline{U}_1$ = the distorted image of the upper scale in Film 1

$\overline{U}_2$ = the distorted image of the upper scale in Film 2

$\underline{L}_1$ = the distorted image of the lower scale in Film 1

$\underline{L}_2$ = the distorted image of the lower scale in Film 2

$X_A\overline{U}_1$ = the distorted *x* co-ordinate of A as measured by the distorted upper scale in Film 1

$X_A\overline{U}_2$ = the distorted *x* co-ordinate of A as measured by the distorted upper scale in Film 2

$X_A\underline{L}_1$ = the distorted *x* co-ordinate of A as measured by the distorted lower scale in Film 1

$X_A\underline{L}_2$ = the distorted *x* co-ordinate of A as measured by the distorted lower scale in Film 2

$X_B\overline{U}_1$ = the distorted *x* co-ordinate of B as measured by the distorted upper scale in Film 1

$Y_B\overline{U}_2$ = the distorted *y* co-ordinate of B as measured by the distorted upper scale in Film 2

etc., for a total of four distorted *x* co-ordinates of A, four distorted *x* co-ordinates of B, four distorted *y* co-ordinates of A, and four distorted *y* co-ordinates of B. The true *z* co-ordinate is obtained as the final step in the graphing (see p. 435). There are no distorted *z* co-ordinates.

DETERMINING THE DISTORTED CO-ORDINATES

In the completed first film, one identifies the image of A and measures its perpendicular distance from $\overline{YU}_1$. This value constitutes one of the four distorted *x* co-ordinates of A and is recorded $X_A\overline{U}_1$. By a similar process, the remaining three distorted *x* co-ordinates of A and the four distorted *x* co-ordinates of B are measured and recorded. The perpendicular distance from the image of A to $\underline{XL}_2$ constitutes one of the four distorted *y* co-ordinates of A and is recorded $Y_A\underline{L}_2$. By a similar process, the remaining three distorted *y* co-ordinates of A and the four dis-

torted *y* co-ordinates of B are measured and recorded.

SPECIAL PLOTTING CHARTS

The authors have used standard millimeter cross-section paper with additional lines and numerals ruled in by hand, but if the method were to be employed routinely, it would be preferable to print special charts.

The *x* chart consists of an upper horizontal line, *xu*, and a lower horizontal line, *xl*, the two being separated from one another by the distance that separated the upper and lower scales during the making of the films. From the center of *xu*, a perpendicular representing the *z* axis drops to the center of *xl*. The two horizontal scales are calibrated in centimeters, with zero at their centers, positive values to the right, negative values to the left. The vertical scale, likewise calibrated in centimeters, has its zero at the lower end.

In the *y* chart the upper transverse line represents the *y* limb of the upper scale and is labeled *yu*, while the bottom line represents the lower *y* limb and is labeled *yl*.

PLOTTING DISTORTED CO-ORDINATES TO OBTAIN TRUE CO-ORDINATES

On the *x* chart one plots on the upper and lower *x* scales the corresponding distorted co-ordinates from the first and second films and then draws two straight lines, one connecting the upper and lower distorted *x* co-ordinates from the first film, the second connecting the upper and lower distorted *x* co-ordinates from the second film. The perpendicular distance from the crossing of these lines to the lower *x* axis constitutes the true *z* co-ordinate of A, designated z_A, and the perpendicular distance from the point of crossing to the *z* axis constitutes the true *x* co-ordinate of A, designated x_A. By similar plotting on the *y* chart, y_A is obtained together with another reading of the *z* co-ordinate which should be identical with the first. Repeating the process for B, the *x*, *y*, *z* co-ordinates of B are obtained and finally from these one computes the deltas of *x*, *y*, and *z* for substitution in Equation No. 15.

III. 90-DEGREE TRIANGULATION

When a mechanical draftsman wishes to portray the dimensions of a solid object, he makes two drawings, the first a view from the front or back, the second a view from the right side or left. Sometimes he finds it desirable to make a plan showing the object from the top or bottom, but frequently the two elevations oriented at 90 degrees to one another suffice. In a similar way, pairs of roentgenograms made at 90 degrees to one another have long been employed in non-quantitative studies of the skull and the skeleton, particularly the fractured skeleton, and it has become commonplace to use them also for examination of the pelvis and the unborn fetus. Until Ball's publication (4), however, there appears to have been no serious attempt to employ such 90-degree pairs for measurement of the pelvis or the fetus.

Roentgenographic 90-degree triangulation involves problems somewhat more complicated than those encountered in the making or interpreting of mechanical drawings because, while the draftsman presents an object as though it were projected by rays of parallel light, the radiologist is dealing with images produced by radiation diverging from a point source.

Even more troublesome is the fact that some anatomical parts, such as the sacral promontory, which show well in the lateral roentgenogram are difficult to locate in the frontal, while others, such as the medial lip of the ischial tuberosity, may be made out reasonably well in the frontal but only with difficulty or not at all in the lateral.

III-A. EMPIRICAL SOLUTION

Ball believes that it is possible to make sufficiently accurate measurements of the fetal skull and the maternal pelvis from an ordinary frontal and an ordinary lateral roentgenogram without recourse to register marks or geometric construction provided target-film distance (D) and table-top-film distance (*e*) are known. Measurements of images seen in the frontal film supply the *d*'s for objects pictured in the lateral film and *vice versa*. For example, in working up a frontal film and a left lateral made with a D of 36 in., Ball measures in the frontal film the distance from the center of the cartilage space at the pubic symphysis to the medial margin of the great trochanter of the left femur and adds 2 cm. This empirical sum, he believes, corresponds closely to one-half the actual or net bitrochanteric distance, and if his assumption is accepted, obviously this value plus *e* will constitute the object-film distance (*d*) for sagittal-plane objects pictured in the lateral film. By the same reasoning, a measurement on the frontal film from the center of the fetal head to the medial side of the left great trochanter plus 2 cm. plus *e* supplies the *d* for the head as it is pictured in the left lateral film.

The *d*'s for the ischial spines and the fetal head needed for the work-up of the frontal film are obtained by measurements on the lateral film. The perpendicular distance from the superim-

posed ischial spines (or presumably from a point midway between them if they are not superimposed) to the posterior surface of the sacrum plus *e* is taken as the *d* for the ischial spines. The perpendicular distance from the center of the fetal head to the posterior surface of the sacrum plus *e* is assumed to be the *d* for the fetal head.

When these *d*'s have been computed, Ball sets his calculator (see Fig. 10) for a D of 36 in. and the *d* of the sagittal-plane objects, measures the gross value of Diameter I in the lateral film (see Fig. 5), swings the calculator arm across to the right until it cuts Scale 3 at this gross value, and reads off on Scale 4 the true or net value of Diameter I. The process is repeated for Diameters II, III, and IV.

In the frontal film, Ball measures the gross bispinous diameter which by a similar employment of the calculator and an empirically determined *d* is reduced to a net value. By the same method, he might determine the occipitofrontal or biparietal diameter of the fetal skull whenever either of these diameters lies parallel with either film, but since the "lie" of the skull is frequently oblique relative to the film, he prefers instead to estimate the volume of the skull, basing his estimate on mean circumference. For the details of the technique for determining skull volume from mean circumference, see Ball's publication (5).

VAN ZWALUWENBURG'S CORRECTION FACTOR FOR SKEWNESS OF FETAL SKULL

Obliquity of the long axis of the skull relative to the plane of the film is not an obstacle to the estimation of skull volume from mean net circumferences, but skewness of this axis relative to the transverse plane of the mother's body[1] makes for an estimate that is too large, the error increasing with increase in the angle of skewness (46). Assuming the fetal head to be a true prolate spheroid and employing a theoretical equation too complicated for routine clinical use, Van Zwaluwenburg (114) has calculated a factor to correct for skewness. With maximum skewness, that is, with the long axis of the head at 90 degrees to the transverse plane of the body, the factor is 0.932. Experimental testing with dried fetal skulls leads Van Zwaluwenburg to conclude, however, that for such material and presumably also for the skulls of unborn fetuses, the factor for maximum or 90-degree skewness is about 0.955, the factor for all degrees being obtainable from the simple equation:

Equation No. 14: $F = 1 - 0.0005\,\theta$

[1] By transverse plane is meant a plane perpendicular to the sagittal plane.

in which F is a factor for multiplying net mean skull circumference, and θ, the angle between the long axis of the fetal skull and the transverse plane of the body of the mother, the angle being measured in that film of a 90-degree pair in which the angle is smaller.

THE METHOD OF REUTER AND REEVES

Reuter and Reeves' (82) recently published method is essentially 90-degree triangulation worked up empirically by placing on the completed films a transparent chart which resembles in some respects Walton's false centimeter chart and in other respects Thoms' isometric scale for the inlet view. The instrument consists of seven distinct scales which for convenience we shall designate *a*, *b*, *c*, *d*, *e*, *f*, and *g*.

The *a* scale appearing at the top of the instrument is used for measurement of the obstetrical conjugate as seen in the lateral film. These authors obtain the values from Walton's false centimeter chart but, of course, they could have calculated them from:

Equation No. 2: $I = O\,\frac{D}{D-d}$

Scale *a* is made up of five parts to adapt it to patients with bitrochanteric distances ranging from 28 to 36 cm.

Scale *g*, lying directly below *a*, is used for measuring the bituberous or bispinous diameter as seen in the frontal film. Like *a*, this scale was taken from Walton's chart or could be computed from Equation No. 2. Scale *g* likewise is divided into five parts to adapt it to patients in whom the height of the ischial tuberosity or the ischial spine, measured from the tabletop, ranges from 4 to 8 cm.

Scale *b* appearing at the lower left of the instrument is simply a protractor for measuring the θ of the inlet in the lateral film.

Scales *c* and *d*, which lie at the center of the instrument, are used for measuring the obstetrical conjugate as it is seen in the frontal film. These scales, like *e* and *f* presently to be described, are analogous to Thoms' isometric scale for the inlet view. On the basis of the lateral film, Reuter and Reeves divide all of their cases into two groups, which we shall designate *c* and *d*, with four subgroups under each, 1, 2, 3, and 4. Group *c* cases are those in which the examination of the lateral film indicates that in the frontal film the sacral promontory lies approximately 11 cm. above the film. Group *d* cases are those in which this value is approximately 9 cm. (This coarse grouping obviously makes for a lack of precision in the

subsequent measurements.) The c_1 cases have 11-cm. promontories and an inlet Θ of 10 degrees, c_2 cases an inlet Θ of 20 degrees, c_3 cases an inlet Θ of 30 degrees, and c_4 cases an inlet Θ of 40 degrees. The d_1 cases have a 9-cm. promontory and a 10-degree Θ. The c scales are represented by short, heavy strokes; the d scales by longer, lighter strokes.

The e scale, crossing the c and d scales at right angles, is used for the measurement of the transverse diameter in the frontal view and, like the other scales, is made up of two parts, one in coarse, heavy strokes for 11-cm. promontories, the other in light, longer strokes for 9-cm. promontories.

The diagonal f scales are for measurement of the oblique diameters of the inlet and they too are in heavy strokes for 11-cm. promontories and light strokes for 9-cm. promontories.

The method of preparing the scale, which is described in part by the authors, admittedly involves a good many approximations and it appears to us that about the same result could be obtained by using an arbitrary correction factor of .85 for all pelvic dimensions in all patients.

III-B-1. SOLUTION OF 90-DEGREE PAIRS BY GEOMETRIC CONSTRUCTION

One of us has shown that when suitable means are employed for registering films, 90-degree pairs may be worked up without empirical assumptions of any sort (45). As originally published, the plan called for the measurement of distances from the optic axes of the films to the images of certain anatomical parts such as the center of the skull, followed by the plotting of these values on special chart paper. Later, hoping to reduce the number of steps and therefore the likelihood of introducing errors, we developed a special calculator which obviated film measurements as far as the estimation of correction factors was concerned. Since the calculator was full scale and the D of our apparatus is 88.5 cm., it was necessary to develop cams and a traveling straight-edge to take the place of the simpler pivoted arm if the instrument was to be kept within reasonable dimensions. The geometry of the film work-up was the same as though two tubes and two Potter grids had been employed, one set for the frontal, the other for the lateral roentgenogram, but actually a single grid and tube were used, the patient standing first with her back, then her side against the film. The original plan required that the patient wear a special obstetrical jacket, but the author presently will publish an improved technique in which a single Potter grid and tube are mounted in a cradle so that after being used for the making of the frontal film, they may be rotated quickly through 90 degrees for the lateral, the patient wearing no special apparatus and lying on her back on the table throughout the examination.

Van Zwaluwenburg (114) does 90-degree triangulation without the aid of a jacket, using instead a three-sided plywood box or base plate that may be attached to and removed from a vertical Potter grid. A longitudinal wire marker is imbedded in the base plate at a known position relative to the center of the beam of radiation and the right and left sides of the box. The frontal film is made with the patient's back to the film, her right side pressed against one side of the box. For the lateral, she stands with her right side against the film, her back pressed against the other side of the box. The films are worked up on an ingenious half-scale calculator similar to the one devised by Hodges but simpler to use and vastly cheaper to build. As in the case of Hodges' earlier ruled charts, Van Zwaluwenburg's calculator requires the measurement of distances from reference points to shadow points, but in careful hands this extra step need not introduce error.

III-B-2. SOLUTION OF 90-DEGREE PAIRS BY CARTESIAN CO-ORDINATES

Campbell and Rubenstein (21) employ a frontal and a lateral film and a Cartesian co-ordinate work-up for the measurement of dried pelves. Unlike Hummel and Hume (II-B-2-a), they use no opaque scales but instead draw the x, y and z axes onto the completed films, basing the construction on the image of an opaque marker. A right-angled cassette holder carries first the frontal, then the lateral film, the opaque marker being attached to the holder so that its image shows at the upper left-hand edge of the frontal film, and the upper right-hand edge of the lateral. Target-film distance (D) is one meter.

OBLIQUE RADIATION

A pelvis is placed sacrum down on the horizontal surface of the cassette holder; the frontal film is inserted beneath it, and with the x-ray tube centered 1 meter perpendicularly above the opaque marker, the first exposure is made. The frontal film is now removed from beneath the pelvis and the lateral film inserted at the side. The tube is moved through 90 degrees until it stands perpendicular to the plane of the lateral film, 1 meter distant from it, and directly opposite the opaque marker, following which the second film is made.

The eccentric position of the tube simplifies the subsequent mathematics but produces images unsuitable for clinical purposes. In radiography of living subjects, it is hard enough to identify all of the shadow points in 90-degree pairs even when the radiation is centered over the centers of the films, rather than their upper corners. The right-angled cassette holder contains neither Potter grid nor Lysholm grid, but, of course, these essentials to raying of the thick trunk parts could be added if the method were suitable otherwise for clinical use.

CONSTRUCTING THE AXES

In the completed frontal film, the *y* axis is drawn as a horizontal line starting at the left at the image of the marker and extending across to the right-hand edge of the film. The *z* axis is a longitudinal line arising at the image of the marker and passing downward along the left-hand edge of the film perpendicular to the *y* axis. In the lateral film the *x* axis arises at the image of the register mark and extends horizontally to the left-hand edge of the film. As in the frontal film, so here the *z* axis passes perpendicularly downward, but in this case it lies at the right-hand edge of the film.

DISTORTED CO-ORDINATES

In the frontal film the perpendicular distance from the shadow of the right ischial spine (A) to the *z* axis is the distorted *y* co-ordinate of *A* (written Y_A) and the perpendicular distance from the shadow of A to the *y* axis is the distorted *z* co-ordinate [written $(Z_A)_F$]. By similar measurements Y_B and $(Z_B)_F$ are obtained. In the lateral film the perpendicular distance from the shadow of A to the *z* axis is X_A, the distance from A to the *x* axis being $(Z_A)_L$. By similar measurements X_B and $(Z_B)_L$ are obtained.

TRUE SPACE CO-ORDINATES

By substituting the distorted *x*, *y*, *z* co-ordinates in equations 16, 17, and 18, respectively, the true co-ordinates are obtained:

Equation No. 16: $x=\frac{(DX)\ (D-Y)}{D^2-XY}$

in which x is true *x* co-ordinate of A or B; D, target-film distance; X, distorted *x* co-ordinate of A or B; Y, distorted *y* co-ordinate of A or B.

Equation No. 17: $y=\frac{(DY)\ (D-X)}{D^2-XY}$

in which y is true *y* co-ordinate of A or B, and Y, distorted *y* co-ordinate of A or B.

Equation No. 18: $z=\frac{DZ_F\ Z_L}{DZ_L+XZ_L}$

in which z is true *z* co-ordinate of A or B; Z_F is distorted *z* co-ordinate of A or B measured in the frontal film, and Z_L is distorted *z* co-ordinate of A or B measured in the lateral film.

The authors state that when one desires to make pelvic measurements with an error less than 4 mm., it is necessary to employ the equations themselves, but for less accurate work they provide a nomogram. A ruler cutting Scale I of the nomograph at the value of X_A and Scale II at the value of Y_A indicates on Scale III the value of the true *x* co-ordinate, x_A.

To find the value of y_A on Scale III, the ruler is placed so that it cuts Scale I at the value for Y_A, and Scale II at the value of X_A.

To *approximate* the value of z_A on Scale III, the ruler is placed in such a position that it cuts Scale I at the value of $(Z_A)_F$ and Scale II at the value of X_A.

FINAL COMPUTATION

Having obtained the true *x*, *y*, *z* co-ordinates of A and B, the true length (L) of the bispinous diameter (or of any other pelvic diameter in which the end-points can be seen in both films) is obtained from the equation:

Equation No. 15: $L=\sqrt{\Delta x^2+\Delta y^2+\Delta z^2}$ (see page 433).

We have cited this article in some detail because it illustrates the point that the employment of sound mathematics does not insure accurate measurement, to say nothing of simplicity or practicability.

IV. ORTHOMETRIC REPRODUCTION

By orthometric reproduction we mean the production of true scale tracings of various sections through the pelvis, such as a tracing from a lateral film with the sagittal plane in orthoprojection and the ischial spines and the ischial tuberosities projected orthographically onto it, or a tracing from a frontal film with the inlet in orthoprojection and the ischial spines and ischial tuberosities projected orthographically onto the plane of the inlet. The magnitude of the various pelvic diameters pictured in such orthograms may be determined by measuring the tracings with an ordinary ruler, but even when pelvic diameters have been measured by some other technique, orthograms based on such measurements constitute an excellent means of making them clinically available.

Not the least important argument in favor of orthograms is the fact that, unlike the written word, these graphic records leave no doubt as to what end-points were employed. Furthermore, if future work were to establish the significance of some pelvic diameter not generally measured at present, it is reasonable to hope that such a new diameter might be found to be measurable in the orthograms of old hospital records.

IV-A. PANTOGRAPHIC REPRODUCTION

The method of "redressment" published by Tengbergen (93) and Litwer (62) is by our terminology a pantographic means of orthometric reproduction. The instrument consists of an offset writing arm equipped with a writing point above the offset and a tracing point below, both points telescoping into sockets against spring pressure. The upper end of the arm is pivoted in a ball-and-socket joint, the center of which is located perpendicularly above the center of a horizontal view-box at a distance corresponding to the D of the x-ray apparatus used in their laboratories. A drawing board is supported above the view-box in a swivel that allows it to be angled relative to the surface of the view-box, the height (d) and angle (Θ) of the board being variable over a considerable range. To use the instrument for the making of an orthogram of a frontal film, one first determines the angle of obliquity (Θ) between the plane of the pelvic inlet and the plane of the film, together with the perpendicular distance from the center of the film to the plane of the inlet (*d*). (For Litwer's particular method of doing this, see his publications. Numerous other methods are available.) A frontal film is now placed on the view-box with its optical axis perpendicularly below the ball-and-socket joint of the writing arm, paper is pinned to the drawing board, and the board adjusted until the Θ and the *d* of its writing surface correspond with these values as determined for the inlet. The tracing point is now carried about the margins of the distorted image of the pelvic inlet, the writing point meanwhile recording on the paper an outline drawing of the inlet in true proportion corrected for oblique and divergent distortion. For a lateral orthogram, the lateral film is placed on the view-box and the writing surface is arranged parallel with the film and at a height above it corresponding to the *d* of the sagittal plane.

We are impressed with the possibilities of the pantograph but suspect that for frontal orthograms at the level of the ischial spines or particularly at the tuberosities, the space between drawing board and film may be so cramped that it will not be possible to operate the tracing point. A linkage pantograph might be designed with the drawing board at the side of the view-box rather than above it and with its axis of rotation at the level of the surface of the film. In such a theoretical set-up, the *d* of the inlet would determine the hook-up of the linkage which in turn would control the amount of reduction in the size of the image. Making the Θ of the drawing board identical with the Θ of the inlet would correct for oblique distortion. We have not ourselves attempted to construct such a pantograph because for the moment we are interested in the production of orthograms by another method.

IV-B. ORTHOSCOPIC REPRODUCTION

Tengbergen (62) has employed a large copying camera for the production of pelvic orthograms. By suitable means he determines the height (d) and the angle of inclination (Θ) of the plane of the inlet relative to the plane of the frontal film. When this has been done, the film is placed on a vertical view-box with a camera mounted in front of it so that the camera lens is perpendicularly opposite the center of the film at a distance exactly the same as the target-film distance (D). The plate holder of the camera is arranged so that its center is separated from the lens by a distance equivalent to the target-object distance (D−d), its surface making an angle with the film exactly equal to the Θ of the inlet. In the negatives produced under these conditions, and, of course, in contact prints made from the negatives, the pelvic inlet appears in true proportion.

Thoms (104), by means of an instrument that he calls a "pelviscope," produces pelvic orthograms from inlet views made with his isometric scale (the perforated plate). The completed film is placed on a vertical view-box and the examiner (keeping one eye closed) looks at it through an eye-piece located perpendicularly opposite the center of the film at a distance equal to the target-film distance (D). A glass plate ruled in centimeter squares is now introduced between the eye-piece and the film and is manipulated until the observer sees the intersections of the vertical and horizontal ruling lines coinciding with the black dots that are the x-ray images of the isometric scale. When this superimposition has been accomplished, it will be found that the distance between the ruled plate and the film and the angle between the two correspond respectively to the object-film distance (d) and the Θ of the inlet.

Still keeping one eye closed, the observer, using a wax pencil, traces onto the ruled plate the outline of the inlet as he sees it. After it has been trans-

ferred from the ruled plate to paper, this orthogram of the inlet is ready for incorporation in the clinical record.

Pauwen and Dumont (76) use a mirror orthoscope for the making of pelvic orthograms. Having determined the *d* and Θ of the pelvic inlet and having calculated the true value of some diameter of the inlet, the examiner places the frontal film on a vertical view-box. A 45-degree semitransparent mirror is mounted with its center perpendicularly opposite the center of the film at a distance equal to the target-film distance (D). A drawing board stands behind the mirror at a distance approximately equal to D and with the angle between this surface and the surface of the film fixed at 90 degrees minus the Θ of the inlet. Keeping one eye closed, the examiner looks through an eye-piece at the image of the inlet which to him appears to be located on the paper-covered surface of the drawing board. While observing the image through the eye-piece, the examiner moves the drawing board toward him until the image of the pelvic diameter in question has exactly the dimension previously determined for it and with the board locked in this position the image of the inlet is penciled in.

One of us will publish presently an orthoscopic method that combines the ideas of several earlier workers. The orthoscope consists of a cork-surfaced bed, adjustable in height, which in the zero position is parallel with the floor and at about table height. Perpendicularly above the center of the bed and at a distance equal to the target-film distance (D) above the zero position, there is mounted a 2.5 diopter spectacle lens. At the same distance perpendicularly above the center of the lens and also parallel with the floor, there are ways that hold a metal-framed glass film-mount and above this mount there is a powerful light source.

To draw an orthogram of the sagittal plane, one makes a lateral roentgenogram and by suitable means of one sort or another measures the *d*'s of the ischial tuberosities, the ischial spines, and the sagittal plane. With a wax pencil the significant shadows of sagittal-plane objects are traced in in solid lines (the outlines of the sacrum and pubic symphysis), and structures outside the sagittal plane in broken lines (the outlines of the iliac blades, ischium, and pubis, including ischial spines and tuberosities—the outlines of the heads and necks of the femurs).

When this has been done, the lateral film is placed in the mount, drawing paper is pinned to the bed, and the bed is raised from its zero position by an amount equal to the *d* of the sagittal plane. The image that appears on the drawing board is now penciled in, part in solid lines, part in broken lines, following which the bed is lowered to the *d* of the lowermost ischial spine and then to the *d* of the lowermost ischial tuberosity so that these structures may be sketched in in solid lines. The resulting tracing constitutes an orthogram of the sagittal plane with the lower ischial spines and tuberosities projected orthographically upon the sagittal plane. In this lateral orthogram, the Θ of the inlet may be measured directly.

By tilting the bed to an angle equal to the Θ of the inlet, adjusting it to the proper height, and inserting a frontal film in the mount, the orthoscope is made ready for the projection of a frontal orthogram.

IV-C. GEOMETRIC REPRODUCTION

Kaufman (57) prepares orthograms of the inlet by geometric construction on tracings from ordinary inlet films. An arbitrary center point is selected from which a dozen or more radii are drawn to the brim of the inlet. Target-film distance (D) is fixed and it is assumed that the measured distance from the pubic symphysis of the patient to the top of the table, plus tabletop-film distance (*e*), corresponds to the object-film distance (*d*) of the inlet. If one accepts this assumption, he may obtain from the graph of Equation No. 1 (Fig. 7) a factor for correcting any dimension of the inlet including the dimensions of these arbitrary radii. As a matter of fact, Kaufman accomplishes the correction by constructing right triangles with *D* as the base, $D-d$ the altitude, *I* a segment of the base, and *O* a corresponding segment of the altitude. The principle is the same, however, as though the graph of Equation No. 1 had been employed.

After all of the radii have been shortened to compensate for divergent distortion, the outer ends of the shortened radii are joined by a curve that follows the shape of the distorted image of the inlet, this inner tracing constituting a reasonably accurate orthogram of the inlet.

Kaufman points out that it is possible to make the orthogram after correcting only one radius. As a preliminary step, chords are drawn from tip to tip of all of the radii in the distorted image of the inlet. One radius is now shortened to compensate for divergent distortion and an inner chord is drawn beginning at the outer end of this shortened radius and lying parallel with the corresponding outer chord. From the intersection of this first inner chord with the second radius, a second inner chord is drawn to the third radius and so on around the circle to the starting point. The rest of the procedure is the same as in the

first method, a system of inner arcs being drawn spanning the inner chords and following as closely as possible the shape of the distorted image of the inlet.

FETOMETRY

Reference has been made previously to certain phases of fetometry and in general it may be said that most techniques suitable for measurement of the pelvis may be used also to measure the skull or other parts of the fetus.

POSSIBLE DANGER TO FETUS

Some workers (8) continue to warn that it is possible to injure an unborn fetus by submitting its mother to diagnostic raying, but few concur in this view. When female patients within or below the child-bearing age have lesions of the lower abdomen or pelvis requiring therapeutic irradiation, it is standard practice to carry the treatment to the point of sterilization or provide for sterilization by other means to avoid risk of the production of defective offspring, but we know of no instance in which *diagnostic irradiation* in an amount tolerated by the skin of the patient has injured an ovary or an unborn fetus.

FETAL AGE FROM EPIPHYSEAL DEVELOPMENT

Hill (43) recently has published the results of x-ray studies of the developing skeleton in 500 fetal cadavers ranging in age from about eight to about forty weeks. Many of the details that he is able to make out in roentgenograms of these dead, extruded fetuses will be indemonstrable in roentgenograms of living, unborn fetuses, but under favorable conditions the following stages of development may be clinically demonstrable:

(1) The semi-circular canals show well at the twentieth week but by the twenty-fourth week they are beginning to be obscured by ossification of the surrounding petrous portion of the temporal bone. The degree at which the canals are obscured varies with individuals, but in all cases the obscurity is marked by the fortieth week.

(2) The parietal bones ossify frequently by the twentieth week, invariably by the twenty-fourth.

(3) The calcaneus appears by the twentieth week, the talus by the twenty-fourth, the cuboid in some females by the thirty-sixth week, and in all females and most males by the fortieth week.

(4) The humeral head has appeared by the fortieth week in some females and fewer males.

(5) Hill's findings relative to the distal femoral and proximal tibial epiphyses are in keeping with the clinical reports of von Bruecke (14), Richter (83), and many others. By the thirty-second week the distal femoral epiphysis is present in females and in some males. By the thirty-sixth week the femoral epiphysis regularly is present in both sexes and the tibial center is present in all females and in a few males. In the fortieth week, both centers are present in both sexes.

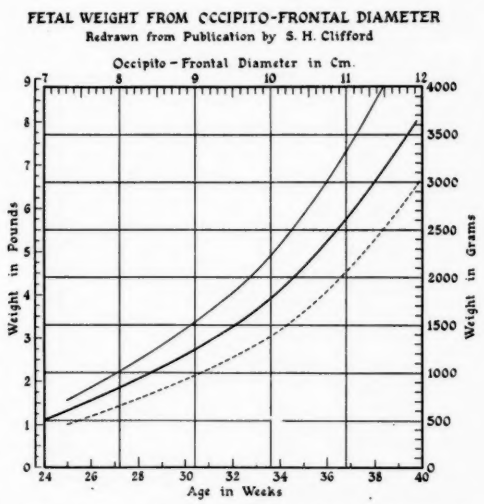


Fig. 12. Graph for computation of fetal weight in grams or pounds from net occipitofrontal diameter. (Redrawn from Clifford's Publication based on his study of 479 fetuses.)

Clifford's curves were constructed empirically from a scatter diagram of the birth weights and occipitofrontal diameters. The heavy solid line shows the mean weight for a given occipitofrontal diameter, the light solid line the maximum weight, the broken line the minimum weight. The age in weeks shown at the base is computed from the equations of Scammon and Calkins.

Body weight correlates with skull diameters less closely than does age.

FETAL WEIGHT FROM SKULL SIZE

Clifford (25) (26) (27) uses a stereoroentgenometer for the measurement of occipitofrontal diameters and a curve of his own construction (Fig. 12) for interpreting occipitofrontal diameter in terms of body weight.

Theoretically, his method of measuring the skull is sound regardless of the lie, but in our experience the end-points are definite only when the occipitofrontal diameter of the skull lies approximately parallel with the film.

FETAL AGE FROM SKULL SIZE OR FEMUR LENGTH

Hodges and his associates measure the fetus usually by direct parallax, sometimes with a

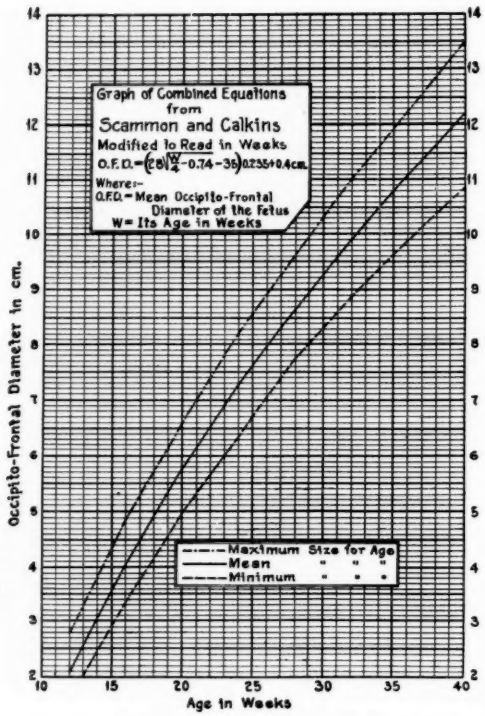

Graph of Combined Equations from Scammon and Calkins
Modified to Read in Weeks
O.F.D.=(28√(W/4−0.74−35)0.235+0.4cm.
Where:-
O.F.D.=Mean Occipito-Frontal Diameter of the Fetus
W=Its Age in Weeks
Maximum Size for Age
Mean " " "
Minimum " " "
Occipito-Frontal Diameter in cm.
Age in Weeks

Fig. 13. Graph for computation of fetal age in weeks from net occipitofrontal diameter. (Graph by Hodges of equation developed by modifying and combining equations of Scammon and Calkins.)

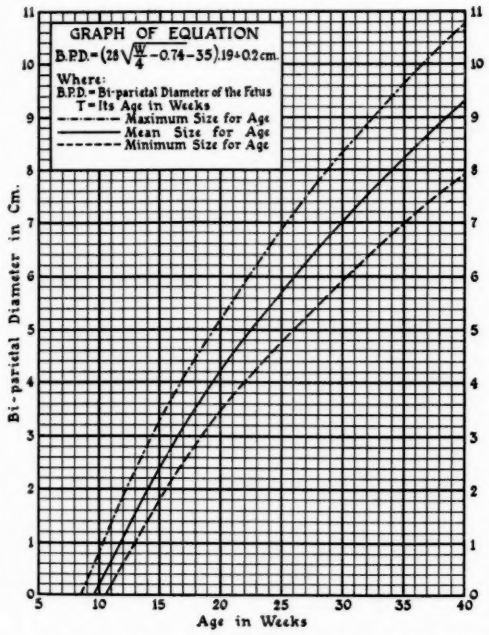


Fig. 14. Graph for computation of fetal age in weeks from bi-parietal diameter. (Graph by Hodges of equation developed by modifying and combining equations of Scammon and Calkins.)

stereoroentgenometer or by 90-degree triangulation. They prefer the occipitofrontal diameter as an index of fetal age, but if this diameter cannot be measured they substitute for it the biparietal diameter, the right-angled circumference, or the length of the femoral shaft. The net measurements of these parts are interpreted in terms of fetal age by means of graphs (Figs. 13, 14, 15, and 16) of equations based on the original work of Scammon and Calkins (86).

Equation No. 20:

$$\text{O.F.D.} = (28\sqrt{\frac{W}{4} - 0.74} - 35)\ 0.235 + 0.4 \text{ cm.}$$

in which O.F.D. is the net length in centimeters of the occipitofrontal diameter, and W is the age of the fetus in weeks.

Equation No. 21:

$$\text{B.P.D.} = (28\sqrt{\frac{W}{4} - 0.74} - 35)\ 0.19 + 0.2 \text{ cm.}$$

in which B.P.D. is the net length in centimeters of the biparietal diameter.

Equation No. 22:

$$\text{A.C.C.} = 8.903\sqrt{W - 2.96} - 21.295$$

in which A.C.C. is the average net circumference of a fetal skull obtained from two roentgenograms taken at right angles to one another.

Equation No. 23:

$$S = \frac{(28\sqrt{\frac{W}{4} - 0.74} - 35)\ 0.19 - 0.81}{1.19}$$

in which S is the length in centimeters of the calcified portion of the femoral shaft.

Reece (80) believes that regardless of the lie of the skull, the shortest diameter of the skull shadow, if not identical with the biparietal diameter, at least will be equivalent to it. He makes a single frontal film with the patient's back supported with pillows in order to bring the inlet more nearly parallel with the film. The *d* of the fetal skull is determined by palpation through the maternal abdomen, and correction for divergent

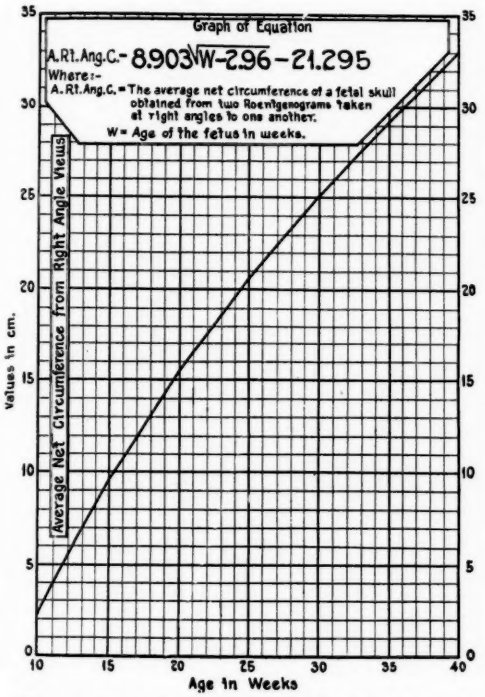

Graph of Equation
A.Rt.Ang.C.- 8.903√W-2.96-21.295
Where:-
A.Rt.Ang.C. = The average net circumference of a fetal skull obtained from two Roentgenograms Taken at right angles to one another.
W = Age of the fetus in weeks.
Average Net Circumference from Right Angle Views
Values in cm.
Age in Weeks

Fig. 15. Graph for computation of fetal age in weeks from average corrected circumference of skull. (Graph by Hodges, based on Ball's original idea and on modified and combined equations from Scammon and Calkins.)

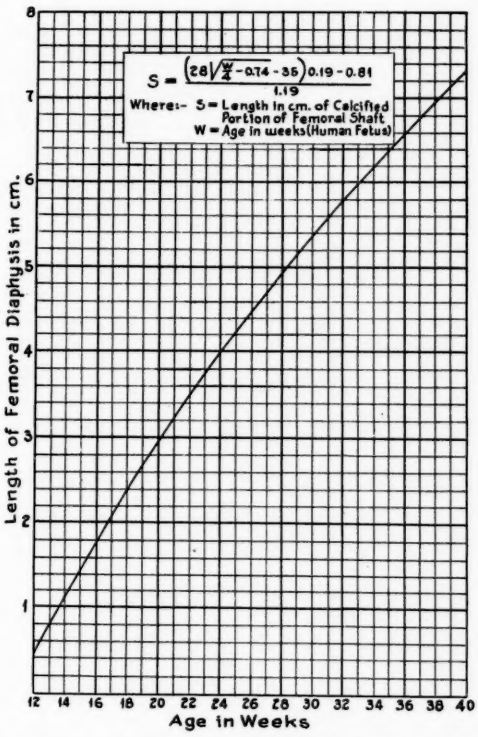

S = (28√(W/4 - 0.74) - 35) 0.19 - 0.81 / 1.19
Where:- S = Length in cm. of Calcified Portion of Femoral Shaft
W = Age in weeks (Human Fetus)
Length of Femoral Diaphysis in cm.
Age in Weeks

Fig. 16. Graph for computation of fetal age in weeks from net length of calcified portion of shaft of femur. (Graph by Hodges based on anthropometric and roentgen measurements by R. Stocking, and modified and combined equations from Scammon and Calkins.)

distortion is accomplished by substitution of this *d* in what amounts to Equation No. 1. The net diameter thus obtained is interpreted in terms of fetal age by means of a rather rough table prepared from the publications of Scammon and Calkins.

Reece recognizes that in all three stages of his work there is a considerable margin of error but he is of the opinion that its simplicity makes up for this.

FETAL AGE FROM VERTEBRAL LENGTH

Wegrad (119) has attempted to estimate the crown-heel length of an unborn fetus by x-ray measurement of the length of its spine, using as end-points the upper surface of the first cervical vertebra and the lower surface of the fifth sacral vertebra. If for convenience we designate this length as V (for vertebral column), Wegrad's finding may be expressed by the following equation:

Equation No. 19: $L = 2.29\ V$

in which L is the crown-heel length of the fetus in centimeters, and V is the length of the fetal vertebral column.

A single film is made with the patient prone and it is assumed that the object-film distance (*d*) of the fetal skeleton is one-half of the measured thickness of the mother's body plus the tabletop-film distance (*e*). The net length of V is obtained by measuring the gross length of the x-ray image of the spine and substituting in Equation No. 1:

Equation No. 1: $O = I\,\frac{D-d}{D}$

At least three factors tend to reduce the accuracy of Wegrad's measurement: (1) the x-ray image of V will be a curve in most cases and therefore not easily measurable with an ordinary ruler; (2) the *d* assumed for the vertebral column is at best an approximation and in some cases

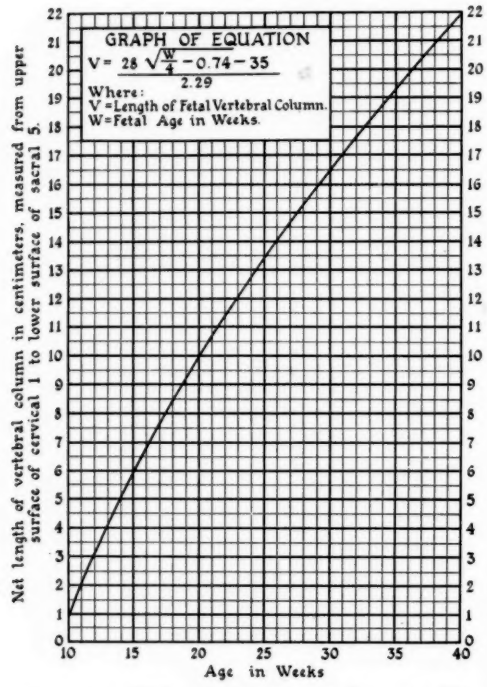

GRAPH OF EQUATION
$V = \frac{28\sqrt{\frac{W}{4} - 0.74} - 35}{2.29}$
Where:
V = Length of Fetal Vertebral Column.
W = Fetal Age in Weeks.
Net length of vertebral column in centimeters, measured from upper surface of cervical 1 to lower surface of sacral 5.
Age in Weeks
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
10 15 20 25 30 35 40

Fig. 17. Graph for computation of fetal age in weeks from net vertebral length. (Equation and graph by Hodges, based on Wegrad's value for length of vertebral column [V] in terms of crown-heel length, and Scammon and Calkins' equation for crown-heel length in terms of age.)

V is the net length (corrected for distortion) of the fetal vertebral column measured along the curve of the column from the upper surface of Cervical Vertebra 1 to the lower surface of Sacral Vertebra 5.

a poor one; and (3) equation No. 1 corrects merely for divergent distortion and the possibility of coexisting oblique distortion is ignored.

Substituting 2.29 V for L in equations based on the Scammon and Calkins material, we have developed Equation No. 24:

$$\text{Equation No. 24: } V = \frac{(28\sqrt{\frac{W}{4} - 0.74} - 35)}{2.29}$$

in which V is the length of the fetal vertebral column, and W is the fetal age in weeks.

This equation, of course, can be expressed as a graph (Fig. 17).

CONCLUSIONS

We are convinced that as a rule x-ray pelvimetry should be based on x-ray images and should be independent of body measurements, but the case of the obstetrical conjugate and other sagittal-plane diameters constitutes a striking exception to this rule. In this case, body measurement provides such dependable information as to the height of the sagittal plane above the film that the use of a calibrated isometric scale in connection with a single lateral roentgenogram clearly is the method of choice.

Granting that the other pelvic diameters are best determined by x-ray measurement alone, which method shall be selected from among the many that are available? Shall it be one requiring a minimum of fixed factors or shall one elect to work with fixed and known target-film distance (D), and tube shift (K), together with some type of automatic film registration? We favor the latter plan because the former, though involving tedious and rather complicated computations, at best is no more accurate. It seems to us not unreasonable that he who wishes to measure something precisely should expect to employ for the work tools that are reasonably precise.

Any mechanic of ordinary ability can modify a commercial x-ray exposing table so that its target-film distance (D) and tube shift (K) are known accurately and so that roentgenograms made on it are capable of accurate registration; and when such changes have been made, the precision of measurements obtained from the films will depend only slightly upon the ability of the technician. The person who works up such films must practice a certain degree of skill, patience, and care, but not more than that required in numerous chemical and microscopic techniques that have become standard practice in medicine.

It is our belief that many laboratories presently will employ for pelvimetry, frontal and lateral pelvic orthograms in which all of the significant pelvic diameters can be measured directly with an ordinary ruler. Pending such development, a reasonably simple and accurate procedure would be the following:

1. Sagittal-plane diameters measured from a single lateral roentgenogram by means of an isometric scale. Placental site noted in this same film if pregnancy is near term.

2. Other pelvic diameters and fetal skull and skeleton studied in stereoscopic frontal films made with the patient on her back with a pad beneath the lower lumbar spine. Quantitative work-up of these stereoscopic films accomplished (a) by plane geometric construction, or (b) by means of a stereoroentgenometer.

The authors wish to record their thanks to Dr. Francis Blonek, radiologist and formerly instruc-

tor in radiology in Prague, Czechoslovakia, for his abstracts of the European literature.

BIBLIOGRAPHY

1. Adair, F. L. Obstetrics and Gynecology. Vol. 2: chap. 21. Philadelphia: Lee and Febiger, 1940.
2. Albert (of Dresden). Verhandl. d. deutsch. Gesellsch. f. Gynaek., 1899: 8: 356.
3. Ball, R. P. Surg., Gynec. & Obst., 1936, 62: 798.
4. Idem. Radiology, 1938, 31: 188.
5. Ball, R. P., and Marchbanks, S. S. Radiology, 1935, 24: 77.
6. Bayer, L. Roentgenpraxis, 1936, 8: 446.
7. Berg, K. Roentgenpraxis, 1936, 8: 447.
8. Bickenbach, W. Zentralbl. f. Gynaek., 1935, 59: 918.
9. Brakemann, O. Arch. f. Gynaek., 1934, 157: 197.
10. Idem. Ztschr. f. Geburtsh. u. Gynaek., 1936, 112: 154.
11. Brault, P., and Tizon, A. Bull. et mém. Soc. d'électro-radiol. méd. de France, 1938, 26: 240.
12. Brouha, M., Pauwen, J., and Dumont, P. Bruxelles-méd., 1938, 19: 178.
13. Brown, W. H., and Dippel, A. L. Bull. Johns Hopkins Hosp., Balt., 1940, 66: 90.
14. Bruecke, H. von. Zentralbl. f. Gynaek., 1936, 60: 1038.
15. Buckner, D. Radiology, 1934, 23: 107.
16. Caldwell, W. E., Moloy, H. C., and D'Esopo, D. A. Am. J. Obst. & Gynec., 1934, 28: 824.
17. Ibid., p. 482.
18. Caldwell, W. E., Moloy, H. C., and Swenson, P. C. Am. J. Roentgenol., 1939, 41: 305.
19. Ibid., p. 505.
20. Ibid., p. 719.
21. Campbell, B., and Rubenstein, B. B. Am. J. Anthropol., 1937, 23: 213.
22. Chamberlain, W. E., and Newell, R. R. Am. J. Roentgenol., 1921, 8: 272.
23. Christensen, H. Acta radiol., 1939, 20: 137.
24. Čížek, J. Roentgenpraxis, 1936, 8: 306.
25. Clifford, S. H. Surg., Gynec. & Obst., 1934, 58: 727.
26. Ibid., p. 959.
27. Idem. West Virginia M. J., 1935, 31: 401.
28. Danelius, G. Fortschr. a. d. Geb. d. Roentgenstrahlen, 1933, 48: 278.
29. Davidson, J. M. Arch. Roentg. Ray, 1898, 2: 64.
30. De Magalhaes, G. A. C. Rev. de gynec. e d'obst., 1937, 31: 437.
31. Dippel, A. L. Surg., Gynec. & Obst., 1939, 68: 642.
32. Francis, C. C., and Werle, P. P. Am. J. Phys. Anthropol., 1939, 24: 273.
33. Fray, W. W., and Pommerenke, W. T. Radiology, 1939, 32: 261.
34. Friedman, L. J., and Euphrat, E. J. Am. J. Roentgenol., 1939, 41: 541.
35. Friedman, L. J., Michels, L. M., and Rossitto, A. F. Surg., Gynec. & Obst., 1935, 61: 735.
36. Garland, L. H. Am. J. Roentgenol., 1938, 40: 359.
37. Granzow, J. Arch. f. Gynaek., 1930, 141: 155.
38. Greulich, W. W., and Thoms, H. J. Am. M. Ass., 1939, 112: 485.
39. Guerriero, W. F., and Smith, W. L. New Orleans M. & S. J., 1938, 91: 299.
40. Hanson, S. Am. J. Obst. & Gynec., 1930, 19: 124.
41. Hayden, C. T. California & West. Med., 1938, 49: 25.
42. Heaton, C. E. New York State J. M., 1938, 38: 83.
43. Hill, A. H. Am. J. Phys. Anthropol., 1939, 24: 251.
44. Hodges, P. C. Am. J. Roentgenol., 1933, 30: 809.
45. Ibid., 1937, 37: 644.
46. Hodges, P. C., and Hamilton, J. E. Radiology, 1938, 30: 157.
47. Hodges, P. C., Hamilton, J. E., and Pearson, J. W. Am. J. Roentgenol., 1940, 43: 127.
48. Hodges, P. C., and Ledoux, A. C. Am. J. Roentgenol., 1932, 27: 83.
49. Holmquest, H. J. Radiology, 1938, 31: 198.
50. Holzapfel, K. Beitr. z. Geburtsh. u. Gynaek., 1898, 1: 286.
51. Idem. Verhandl. d. deutsch. Gesellsch. f. Gynaek., 1899, 8: 360.
52. Hummel, A. D., and Hume, O. S. Physical Rev., 1937, 51: 60.
53. Jacobs, J. B. Am. J. Obst. & Gynec., 1936, 32: 76.
54. Idem. Radiology, 1937, 28: 406.
55. Johnson, C. R. Am. J. Surg., 1930, 8: 151.
56. Judson, H. A. Am. J. Roentgenol., 1936, 36: 928.
57. Kaufman, J. Radiology, 1936, 27: 732.
58. Kerr, J. M. M. Brit. M. J., 1939, 1: 857.
59. Kimmig, K. Zentralbl. f. Gynaek., 1939, 63: 642.
60. Knebel, R. Muenchen. med. Wchnschr., 1939, 86: 496.
61. Lambert, G., and Grunberg, M. Rev. franç. de gynéc. et d'obst., 1937, 32: 529.
62. Litwer, H. J. Obst. & Gynaec. Brit. Emp., 1936, 43: 1158.
63. Madsen, V. Acta obst. et gynec. Scand., 1937, 17: 53.
64. Martius, H. Monatsschr. f. Geburtsh. u. Gynaek., 1937, 106: 257.
65. Moloy, H. C., and Swenson, P. C. Diagnostic Roentgenology, pp. 755–826. New York: Thomas Nelson & Sons, 1938.
66. Moore, G. E. Surg., Gynec. & Obst., 1933, 56: 101.
67. Muellerheim, R. Deutsche med. Wchnschr., 1898, 24: 619.
68. Idem. Verhandl. d. deutsch. Gesellsch. f. Gynaek., 1899, 8: 357.
69. Naendrup, H. Med. Welt, 1938, 12: 1416.
70. Nicholson, C. Lancet, 1936, 2: 615.
71. Idem. J. Obst. & Gynaec. Brit. Emp., 1938, 45: 950.
72. Nixon, W. C. W. Practitioner, 1939, 142: 163.
73. Nuvoli, U., and Capua, A. Ann. di radiol. e fis. med., 1936, 10: 470.
74. Orley, A. Brit. J. Radiol., 1933, 6: 345.
75. Paci, G. Riv. d'ostet. e ginec. prat., 1938, 20: 277.
76. Pauwen, L. J., and Dumont, P. Arch. d'électric. méd., 1938, 46: 55, 65.
77. Poppel, M. H. Am. J. Roentgenol., 1939, 42: 721.
78. Portes, Mayer, and Mathieu. Bull. Soc. de gynéc. et d'obst. de Par., 1938, 27: 60.
79. Rappaport, E. M., and Scadron, S. J. J. Am. M. Ass., 1939, 112: 2492.
80. Reece, L. N. Proc. Roy. Soc. Med., Lond., 1935, 28: 489.
81. Reichenmiller, H. Muenchen. med. Wchnschr., 1937, 84: 1254.
82. Reuter, E. G., and Reeves, R. J. Am. J. Roentgenol., 1939, 42: 847.
83. Richter, H. Monatsschr. f. Kinderh., 1938, 72: 215.
84. Robbins, O. F. J.-Lancet, 1937, 57: 418.
85. Ruge, C. Ztschr. f. Geburtsh. u. Gynaek., 1937, 115: 305.
86. Scammon, R. E., and Calkins, L. A. The Development and Growth of the External Dimensions of the Human Body in the Fetal Period. Minneapolis: The University of Minnesota Press, 1929.
87. Schaefer, G. Ztschr. f. Geburtsh. u. Gynaek., 1937, 115: 195, 331.

88. SCHUMAN, W. Am. J. Obst. & Gynec., 1934, 28: 497.
89. SNOW, W. Am. J. Roentgenol., 1939, 41: 537.
90. SNOW, W., and ROSENSOHN, M. Am. J. Roentgenol., 1939, 42: 709.
91. SODRÉ BORGES, R. Rev. de gynec. e d'obst., 1936, 30: 447.
92. STEELE, K. B., WING, L. A., and MCLANE, C. M. Am. J. Obst. & Gynec., 1938, 35: 938.
93. TENGBERGEN, J. Acta radiol., 1929, Supp. 3, 57.
94. THOMAS, H. Am. J. Roentgenol., 1932, 28: 391.
95. THOMS, H. The Obstetric Pelvis. Baltimore: Williams and Wilkins Co., 1935.
96. Idem. Am. J. Obst. & Gynec., 1922, 4: 257.
97. Idem. J. Am. M. Ass., 1925, 85: 253.
98. Idem. New England J. Med., 1929, 200: 829.
99. Idem. Radiology, 1933, 21: 125.
100. Idem. Surg., Gynec. & Obst., 1933, 56: 97.
101. Ibid., 1935, 60: 680.
102. Idem. Am. J. Obst. & Gynec., 1937, 34: 150.
103. Idem. Am. J. Surg., 1937, 35: 372.
104. Idem. Radiog. & Clin. Photog., 1937, 13: 10.
105. Idem. Am. J. Obst. & Gynec., 1939, 37: 101.
106. Idem. Mod. Hosp., 1939, 52: 74.
107. THOMS, H., and WILSON, H. M. Yale J. Biol. & Med., 1937, 9: 305.
108. Ibid., 1938, 10: 437.
109. Ibid., 1939, 11: 179.
110. TORPIN, R. Am. J. Obst. & Gynec., 1938, 35: 683.
111. Idem. J. Obst. & Gynaec. Brit. Emp., 1938, 45: 993.
112. TORPIN, R., HOLMES, L. P., and HAMILTON, W. F. Radiology, 1938, 31: 584.
113. TURNER, W. J. Anat., 1886, 20: 125.
114. VAN ZWALUWENBURG, B. R., Dept. of Roentgenology, University of Michigan, Ann Arbor. Personal communication; paper presently to appear.
115. WAHL, F. A. Arch. f. Gynaek., 1932, 151: 587.
116. Ibid., 1934, 158: 755.
117. Ibid., 1939, 168: 1.
118. WALTON, H. J. Surg., Gynec. & Obst., 1931, 53: 536.
119. WEGRAD, H. Zentralbl. f. Gynaek., 1937, 61: 373.
120. WEINTRAUB, S., and SNOW, W. Am. J. Roentgenol., 1939, 42: 718.
121. WEITZNER, S. F. Am. J. Obst. & Gynec., 1935, 30: 126.
122. WESTERGAARD, B. Acta radiol., 1939, 20: 33.
123. YAMABE, A. Jap. J. Obst. & Gynec., 1937, 20: 52, 147.

ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

HEAD

Asherson, N.: Acute Osteomyelitis of the Superior Maxilla in Young Infants. *J. Laryngol. & Otol.*, 1939, 54: 691.

Acute osteomyelitis of the superior maxilla in young infants presents a typical and constant clinical picture which enables the condition to be identified in spite of the great rarity of its occurrence. It results from a staphylococcal infection of the socket of the unerupted first deciduous molar tooth and the adjacent part of the superior maxilla. Whether the maxilla is involved before the tooth socket, or whether the tooth socket is primarily affected, cannot be stated with certainty. In the 4 cases recorded by the author the infection involved the anterior part of the superior maxilla and the tooth socket, and rapidly spread in all directions at an early stage of invasion. Superiorly it extended to the orbit and anteriorly to the canine fossa, and formed an adjacent and continuous abscess in both these regions. Inferiorly, the infection spread to the alveolar process and the contiguous region of the hard palate, in both of which sites swellings and abscesses formed. Posteriorly, the maxillary antrum was involved.

The abscesses in all the regions mentioned, whether they are drained surgically or rupture spontaneously, give rise to multiple fistulas. These fistulas are external, buccal, alveolar, and/or palatal. Later, sequestra form and may be spontaneously extruded, or be the cause of the persistent fistula, until removed by operation. The deciduous molar may be spontaneously extruded.

The source of the infection is a matter of conjecture. The great incidence of the disease within the first few weeks after birth has led to a search for the source of the infection in the mother, e.g., from organisms in the mother's genital tract, or from cracked or ulcerated nipples. Birth injuries, the use of instruments, and abrasions have been looked upon as possible causes. In many of the recorded cases, infection due to the staphylococcus has been present in other parts of the body of the infant. The disease may affect infants of all ages, but usually it occurs in infants within the first few weeks of life up to eighteen months of age.

Starting with a feverish attack, the onset is sudden, and the characteristic symptoms develop rapidly within a few days. Within twenty-four hours the eyelids suddenly become swollen and edematous on one side. Chemosis of the bulbar and palpebral conjunctivæ occur. There is proptosis and ophthalmoplegia. Soon there develops a unilateral purulent nasal discharge, from which the staphylococcus can be cultured. Induration and swelling of the cheek is a predominant feature and may be the first sign of the disease. A swelling simultaneously develops over the entire molar region of the superior alveolus, and may rupture early to produce a fistula discharging pus. Last of all a palatal swelling develops in the region of the hard palate in juxtaposition with the alveolus. This palatal swelling extends posteriorly the entire length of the hard palate but medially does not extend beyond the midline. The swelling usually ruptures spontaneously, anteriorly close to the alveolus. If not operated upon, the abscesses in the orbit will rupture spontaneously externally through the lower eyelid and give rise to a persistent fistula. Fistulas may form also in the canine fossa, and in the alveolus and the palate, or these may all occur together.

An x-ray of the antra of the infant is of little or no value, as it does not show up the small antrum successfully. The first or septicemic stage of acute osteomyelitis persists for about ten days. With spontaneous external rupture of the abscess, or surgical drainage, the temperature drops, and the case passes into a second chronic or indolent stage of fistula formation and sequestration of dead bone. This may last for many months, particularly if adequate and thorough surgical measures are not instituted at an early stage. The infant may succumb within a few days from sepsis and bronchopneumonia or at a much later date from a brain abscess. It is during the acute stage that active treatment is essential if life is to be saved.

With the drop in temperature, improvement sets in. During the second chronic indolent stage, the facial, canine and palatal fistulas form or persist, and discharge pus. Small or large sequestra form, from the orbital margin and from the region of the canine fossa, and an unerupted tooth may even be extruded as a sequestrum. The formation and extrusion of these sequestra through the mouth fistula may continue for months without affecting the health or progress of the infant. The facial sinus may persist or heal, but break down from time to time. The danger to life is present during the first ten days during the acute septicemic stage. The second stage may persist for years.

Operation during the acute stage incorporates:

1. Drainage of the orbital abscess by an external incision.
2. Counter-drainage through the medial wall of the orbit, through the anterior part of the middle meatus, into the nose. A rubber drainage tube is inserted through the external incision, down to the orbit, and the external incision is left unsutured.
3. The maxillary antrum is drained by an antrostomy in the inferior meatus.

4. The abscess in the canine fossa, and/or the alveolus, is incised through the mouth.

As a rule within the first few days of the illness, when this operation is indicated, sequestra have not formed and it is not necessary to search for them. After the first stage has passed, usually at the end of the second or third week, further operation or operations may be necessary to locate and remove any sequestra. NOAH D. FABRICANT, M.D.

EYE

Ballantyne, A. J.: Eye Casualties on the Home Front. *Glasgow M. J.*, 1939, 132: 180.

Eye casualties on the home front consist of all the injuries seen during peace time plus injuries due to high explosive bombs, incendiary bombs, and gas. The injured should be transported as speedily as possible to hospitals and given expert treatment.

Injuries due to high explosives usually are caused by flying bits of stone or other material, rather than metal. Some of these foreign bodies may be inert, but in many cases enucleation will be necessary. Various types of intra-ocular foreign bodies are mentioned and their treatment is discussed. Non-shatterable glasses are advised for A R P workers, even if they have no refractive error. Incendiary bombs produce two types of burns. Direct contact with flame may completely destroy the corneal epithelium, so that the eye looks like a "boiled fish." However, within a few hours the epithelium is entirely regenerated, with complete recovery of vision. Burning fragments may produce very severe and permanent corneal damage.

From the ophthalmic viewpoint, gas is divided into tear, lung-irritant, and blistering gas. The first is unimportant so far as permanent damage is concerned. Early irrigation of the eyes suffices for this as well as for the lung-irritant gas. The vesicant gases are much more serious. Usually the symptoms occur several hours after exposure, but first-aid treatment, consisting of irrigation and the instillation of liquid paraffin, is effective only in the first few minutes. When symptoms once develop, specialist care is essential. SAMUEL A. DURR, M.D.

Loewenstein, A.: Eye Casualties at the Front. *Glasgow M. J.*, 1939, 132: 169.

While the eyes comprise only one-three-hundredth of the body surface, they are injured in one-tenth of all military casualties. Both metallic and stone foreign bodies from grenades or shells produce injuries, the latter causing 90 per cent of these injuries.

Infection is rare, and it is usually *not* desirable to extract such foreign bodies from the cornea. Even in the iris these particles are usually non-irritating, and in most cases may be left safely for treatment at a base hospital. The removal of prolapsed iris is urgent, but can usually wait a day or two for treatment by a trained ophthalmologist. Enucleation of an eyeball is never urgent and should always be left for the decision of a specialist.

The old figures on the frequency of sympathetic ophthalmia, 55.6 per cent in the Franco-Prussian war, no longer apply. Out of thousands of penetrating eye injuries in the last war, there was 1 case of sympathetic disease in the French army and 8 in the German. "Lead sprays" of the cornea, caused by a bullet's striking a stone, heal well if treated antiseptically. The lead should not be removed. Vossius-ring cataract is fairly frequent, as is commotio retinæ. No case of hole in the macula or detached retina occurred following the latter injury. No case of "windage" of the cornea was seen, nor was any recorded in the British army. Discoid opacity of the cornea may occur following the explosion of land mines, but it disappears promptly. Intra-ocular foreign bodies should be treated by specialists in base hospitals, and should usually be left in position if the eye is not inflamed. Very few of the metallic foreign bodies are magnetic. Skull injuries should be examined daily by an ophthalmologist for evidence of increasing intracranial pressure.

It is important that all soldiers wearing glasses should have an extra pair. Purulent conjunctivitis in the trenches is very often gonorrheal, and the possibility of trachoma should be remembered in some countries. Trachoma among healthy soldiers is surprisingly mild. Night blindness is often due to uncorrected refractive errors.

SAMUEL A. DURR, M.D.

Terry, T. L.: Malignant Melanoma, So-Called Sarcoma, of the Uvea. Problems in Diagnosis. *Arch. Ophth.*, 1939, 22: 989.

In this very well illustrated and detailed article, the author states that mistakes in the diagnosis of malignant melanoma are numerous. They are of two general types: (1) failure to discover the presence of the tumor, and (2) confusion of some other pathological condition with malignant melanoma.

From his study of this disease, the author has reached the following conclusions:

1. Failure to remove an eye containing a malignant melanoma is a greater mistake than erroneous removal of an eye thought to contain the neoplasm.

2. Malignant melanoma of the ciliary body and choroid are hidden frequently by a variety of disease conditions.

3. Malignant melanoma must be suspected in every instance of unilateral glaucoma, separation of the retina, iridocyclitis, and endophthalmitis.

4. Hopelessly injured eyes and all painful blind eyes should be enucleated because they may contain malignant melanomas.

5. Operations to relieve pain and the congestion of glaucoma in blind eyes are to be avoided; enucleation is the safer procedure.

6. Operation through the sclera for separation of the retina which does not obtain a flow of the subretinal fluid and does not reduce the amount of the separation suggests the presence of a choroidal neoplasm.

7. Evisceration of an eye possibly containing a malignant melanoma is to be avoided.

8. Malignant melanomas have simulated discoid degeneration of the macula, localized inflammatory tumors of the choroid, spontaneous separation of the choroid, subchoroidal hemorrhage, localized melanosis oculi, benign melanoma, angioma, metastatic carcinoma, metastatic chorio-epithelioma, retinoblastoma, and neurofibroma.

9. Differentiation of discoid degeneration of the macula from malignant melanoma is important because it does not necessarily destroy vision, it is often bilateral, and it may tend to heal. This differentiation may be possible only by prolonged observation.

10. Angioma of the choroid may be observed to collapse partially from digital compression on the eyeball.

11. Metastatic carcinoma differentiated by a flat unpigmented appearance, tending to be bilateral and present in the lungs, does not call for enucleation of the eye.

12. Metastatic chorio-epithelioma can be differentiated by the presence of a uterine, ovarian, or testicular tumor and by a positive pregnancy test.

13. Retinoblastoma having been found in the fourth decade, and malignant melanoma in the first decade of life, age is of no value in differentiation. It may be necessary to rely on the ophthalmoscopic appearance and on the presence of calcium (psammoma bodies), as shown by roentgen examination, to differentiate between the retinal tumor and the non-pigmented malignant melanoma that has invaded the retina.

14. The most important single diagnostic criterion of malignant melanoma is the appearance of the fundus with evidence of a solid mass immediately beneath a non-tremulous separated retina.

15. Mistakes in transillumination can result from improper placing of the light, too large a source, and too bright a light.

16. Transillumination as a diagnostic method may be misleading; an unpigmented neoplasm (leucosarcoma) may be transilluminated clearly; many growths other than malignant melanoma may not be transilluminated.

17. Transillumination is the only available clinical evidence of the presence of an intra-ocular neoplasm when the interior of the eye cannot be seen.

18. More accurate information can be obtained by Burke's and Weve's methods of transillumination than by watching the pupil for general illumination of the interior of the globe.

19. Except when a malignant melanoma is extremely small, it gives rise to a defect in the visual field.

20. Vascularization of the surface of the iris characteristic of hemorrhagic glaucoma may also be associated with glaucoma secondary to malignant melanoma.

21. A general physical examination for evidence of metastasis, and a test for melanuria should be a part of each diagnostic survey for malignant melanoma.

LESLIE L. MCCOY, M.D.

Borges de Souza, A.: Detachment of the Retina (Le décollement de la rétine). *Presse méd.*, Par., 1939, 47: 1537.

The author presents and subjects to statistical analysis 501 cases of detachment of the retina observed in the Lisbon clinic. They occurred with equal frequency in men and women, and almost half of the cases were found in patients between forty and sixty years of age. More than half of them were associated with myopia, 4-9 D being the most usual degree. Traumatism was mentioned in the case histories in 33 instances. Heredity appeared incontestably associated in some cases, particularly in disinsertions of the ora serrata, in which symmetrical disinsertions of the ora were observed in both eyes in a father and daughter. Bilateral detachments of the retina were observed in 15 patients.

Ten "spontaneous cures" are recorded, but the author had personally observed only 2 of them, both of which occurred in the same patient. The subject, aged sixteen years, myopic to 16 D., presented a detachment of the entire external half of the retina of the right eye, which healed after two injections of sodium chloride under the conjunctiva. Twelve years later the right eye remained well, but a detachment of the entire upper half of the retina of the left eye was observed. With a compressive dressing and subconjunctival injections of sodium chloride, complete healing was obtained n two months. However, spontaneous healing of detachment is an exceptional phenomenon.

Tears or breaks in the retina were observed in almost all of the cases which were thoroughly studied and which came to operation. An ophthalmoscopic method, similar to the schema of Amsler, was used for their localization.

Of the 228 detachments which were operated upon by the author, 161 healed. The healing was confirmed, in each instance, by ophthalmoscopic examination. The author usually avoided resection of any of the rectus muscles, but found it necessary in 59 cases. It was necessary to disinsert two tendons in 1 case, but never more than this for fear of nutritive disturbances consequent to the interruption of the arteries within the muscles. A detailed description of the operative technique is appended.

FRANK MCDOWELL, M.D.

Evans, P. J.: The Underlying Causes of Glaucoma: Including Notes on the Lines of Inquiry Which Have Been Pursued, with Suggestions as to Future Research in Clinic and Laboratory. *Brit. J. Ophth.*, 1939, 23: 745.

After presenting a historical survey of past and present theories on the underlying causes of glaucoma, the author concludes that primary glaucoma is essentially a syndrome of vascular origin and represents a local manifestation of a general vasomotor disturbance.

The hypothesis put forward in this essay is that the causes of primary glaucoma are those of capillary and venous stasis, and that the condition arises from the changes resulting from such a disturbance of the local circulation. It is also held that the syndrome known as glaucoma includes a number of separate conditions the only common features of which are those represented by ultimate decompensation of the mechanism provided for the excretion of fluid from within the eye. It will be shown that primary glaucoma or glaucoma simplex is the local manifestation of a general disease or, in the words of Lagrange (1922), "The eye attacked by hypertension is a sick eye in a sick body and is not merely a hypertonic organ but also a sclerosed and dystrophic organ that shares the trouble with the rest of the body."

In some cases of glaucoma associated with new growths, increased tension occurs relatively early, in others relatively late. The difference lies in the position of the tumor: if situated at the posterior pole or in the posterior half of the globe it is slow to produce raised tension; if it obstructs the venous return from the eye by encroachment upon the ciliary body or the vorticose veins it produces an early rise in the tension.

The hypothesis for the vascular basis of primary glaucoma which is put forward in this essay maintains that the underlying cause of glaucoma is essentially one of defective vascular nutrition, and that it is the capillary and venular portions of the circulation which are for the most part involved.

In his study of the effect of drugs on the glaucomatous eye the author concludes that neither the obliteration nor the opening of the filtration angle by the drugs is the deciding answer, but that the effect on the uveal circulation is the chief factor.

A further important influence of these drugs on the uveal circulation arises indirectly from their action on the ciliary muscle. The circulation through the system of anterior ciliary vessels and, particularly, the question of venous return from this region is largely bound up with the pumping action of the ciliary muscle, the fibers of which encompass these vessels and largely assist the circulation. Paralysis of the ciliary muscle by atropine and its related drugs is a potent factor in establishing stasis in this, the major vascular area of the uveal tract. Eserine, pilocarpine and acetylcholine, on the other hand, stimulate and assist the venous return from this area. The action of atropine is to neutralize the effects of these drugs by preventing the passage of the stimulus from the acetylcholine, which exists between the nerve ending and the effector cell (Fraser, 1938), to the plain muscle of the blood-vessel wall.

Other factors in the production of capillary and venous stasis are: emotional instability, imbalance between the sympathetic and parasympathetic control of the intra-ocular circulation, action of the hormones, arteriosclerosis, and general disease.

Contributory factors are: the proportionate size of the lens to the eye as a whole, the hypertrophy of the ciliary muscle and increased size of the lens in the hyperopic eye as life advances, sclerosis of the trabeculæ and deposits of pigment granules and exfoliated anterior lens capsule in the filtration angle.

Space does not permit further abstraction of this article. It is worthy of every ophthalmologist's careful consideration. LESLIE L. McCOY, M.D.

MOUTH

Sachs, M. D.: Metastases from Carcinoma of the Tongue. *Am. J. Roentgenol.*, 1939, 42: 833.

One hundred and forty-seven cases of cancer of the tongue were seen at the San Francisco County Hospital between 1919 and 1938. Histological confirmation of the diagnosis was obtained in 79 patients, all of whom had squamous carcinoma. The male to female ratio was 14 to 1 and the greatest number of cases occurred in the sixth decade. The first symptom in the great majority of patients was pain referred to the tongue, though a few patients first noted a mass in the neck. The duration of the disease from the onset of the symptoms to hospital entry of the patients averaged seven months and to death eighteen months. In this series, practically all the patients had extensive lesions involving one-half or more of the tongue on admission and all showed cervical-node metastases at some stage of the disease.

There is no discussion of treatment methods or end-results but the routes of metastasis are emphasized. Carcinomas of the tip and lateral borders of the tongue metastasize most frequently to the submaxillary lymph nodes, while those primary on the dorsum or base of the tongue go most frequently to the upper deep cervical chain. Forty-two per cent of the patients had bilateral involvement of the cervical nodes and distant metastases were noted in 8 (5.4 per cent). The author believes that more careful studies would reveal a higher incidence of such metastases and lead to a more careful evaluation of radical surgical procedures for cervical-node metastases. JOHN L. POOL, M.D.

NECK

Weinberg, T.: Sarcoma of the Trachea. A Report of 2 Cases. *Am. J. Cancer*, 1939, 37: 201.

Two cases of sarcoma arising in the tracheal wall are presented from the Mt. Sinai Hospital of New York. The first occurred in a male of fifty years. The condition ran a course of four and one-half years, with inspiratory dyspnea, emphysema, and finally death from cardiac failure and bronchial pneumonia. Treatment had consisted of repeated endoscopic removal of tumor fragments from the trachea. Autopsy revealed a peritracheal and endotracheal tumor, 5 cm. in diameter, situated on the right lateral wall at the level of the third and fourth rings. The narrowed airway was largely due to extrinsic compression, and erosion and collapse of the cartilaginous rings. The tumor contained

lymphoid areas but was not invading adjacent nodes. Its structure was myxomatous, although biopsies had suggested a salivary origin.

The second case occurred in a man thirty-four years of age, a concrete mixer by trade. His condition lasted only a year. The first symptoms were cough and hemoptysis, but the terminal picture was again that of emphysema, anoxemia, and cardiac failure. Little relief was secured either by endoscopic removal or deep x-ray therapy. This tumor lying at the eighth tracheal ring grew mainly into the tracheal lumen and metastasized to dependent portions of the bronchi and lungs. Microscopically it was a spindle-cell sarcoma.

Both cases represent rare tumors of relatively slow growth and low malignancy, causing death by mechanical embarrassment of the respiration and subsequent cardiac failure. JOHN L. POOL, M.D.

Boyce, F. F.: Toxic Thyroid Disease as a Surgeon Would Have the General Practitioner Conceive It; with a Special Note on the Liver Factor. *Mississippi Valley M. J.*, 1940, 62: 2.

All toxic thyroid disease begins as non-toxic thyroid disease. It is a progressive disease process in which clinical and histological manifestations parallel each other. A realization of this progressive nature of the disease and the potentialities inherent in the so-called innocent goiter should lead to early surgery, because the mortality is very low. Two possibilities are inherent in every case of thyrotoxicosis —cardiac and hepatic degeneration. A thyroid heart *per se* probably does not exist, but is a consequence of the superimposed thyroid burden. Liver damage is the chief factor in death from thyrotoxic crisis. The extent of the liver damage should be ascertained in every case of thyroid disease. The author prefers Quick's hippuric-acid test. Serial determinations of this sort permit the observation of liver repair. Glucose and dehydrocholic acid bolster the liver before and after the operation. However, liver damage is apparent even in non-toxic goiters, in 83.2 per cent of the cases of diffuse thyroid disease and in 77.7 per cent of the cases of non-toxic adenoma, according to the author. B-avitaminosis is common in cases in which anorexia and tachycardia are part of the symptoms.

Thyrotoxic crisis may develop in any case and fully 50 per cent of the deaths are due to that factor. It is more common in elderly patients, and particularly dangerous in negro women. The diagnosis of thyrotoxicosis is not always easy. It should be suspected not only in the full-blown case, but even in cardiac patients who have nodular or diffuse goiters. Among the various tests, the basal metabolism rate is valuable, but thyrotoxicosis is not excluded even by subnormal rates. In addition, Quick's liver-function test, cardiac-exercise test, and such a simple test as the increase in the pulse rate when the patient gets out of bed are advisable. The various blood-iodine tests are too complicated. The value of iodine therapy in the pre-operative preparation is undisputed, but no evidence exists of its curative value.

Medical management carries a mortality rate of from 3.4 to 16.1 per cent, and many patients, though alive, are nervous or cardiac invalids. Surgery has a mortality of 5 per cent in inexpert hands and 1 per cent in skilled hands. It should be done in most of the innocent goiters, and in all conditions like diabetes, and pregnancy, and in cardiac patients in whom the condition promises to increase the metabolic load. Delay should be the rule in congestive heart failure, emotional instability, rapid weight loss, and in patients with a poor response to the exercise-tolerance test. Thyroidectomy is never an emergency procedure.

The medical man should recognize toxic thyroid disease, learn how to manage it, and call the surgeon as soon as it is apparent that medical measures will not suffice. In conjunction with the surgeon he should care for the postoperative medical complications and supervise the postoperative life of the patient for many months. There will be always an unavoidable surgical mortality percentage, but that can be reduced, particularly if the surgeon and the physician co-operate in reducing the duration of the pre-operative toxicity. FRED S. MODERN, M.D.

New, G. B., and Erich, J. B.: Congenital Cysts of the Larynx: Report of a Case. *Arch. Otolaryngol.*, 1939, 30: 943.

Congenital or embryonic cysts of the larynx are of interest to the laryngologist primarily because of their extreme rarity. In fact, any type of cyst is seen rather infrequently in this region. Of 722 benign laryngeal tumors encountered at the Mayo Clinic prior to 1938, only 35 were cysts, and of these, but 1 was of embryonic origin. Since then, 2 other cases of congenital cysts of the larynx have been encountered, 1 of which was reported in this article.

Cysts of the larynx are of 3 types: mucous, hemorrhagic, and congenital.

Laryngeal cysts of the mucous and hemorrhagic varieties are not true tumors; that is, they are composed of cells which fulfill no physiological function. On the contrary, they represent the physiological culmination of traumatic or inflammatory processes. Embryonic cysts in the larynx, on the other hand, are genuine neoplasms.

The cause of these congenital cysts has attracted the authors' attention. Schneider brought forth the hypothesis that such tumors arise from displaced embryonal cells which take part in forming the appendix of the ventricle. After considerable study, the authors are inclined to believe that Schneider's hypothesis is correct.

Although congenital laryngeal cysts have been observed in newborn infants, these tumors need not be present necessarily at birth. Some of them are first apparent in individuals who have reached adult life. However, if small, these cysts may exist for many years without producing any symptoms. Generally, their growth is extremely slow, but should these

cysts become infected, their dimensions may increase with alarming rapidity.

There are no symptoms diagnostic of a congenital cyst of the larynx. The signs and physical complaints are not characteristic of any specific tumor; they are, in fact, typical of any laryngeal lesion.

The diagnosis must be based on visual inspection of the larynx. These cysts are confined to the lateral wall of the larynx, or may bulge into the aryepiglottic fold. A few penetrate the thyrohyoid membrane and expand into the neck. Usually, they have a smooth, shiny, semi-translucent, tense, and cystic appearance. In some instances, blood vessels course over their surface. When touched with a probe they are compressible. The nature of such cysts, if situated deeply in the lateral laryngeal wall, may not be obvious, since the structures composing the lateral wall are merely pushed into the lumen of the larynx. Many congenital cysts that involve the aryepiglottic fold are of such large dimensions as to block completely a view of the glottis. In some such cases, it is amazing to observe the small amount of respiratory difficulty experienced by the patient. This, of course, is based on the very gradual increase in the size of the cyst, which obstructs the larynx so slowly that the patient is entirely unaware of and becomes accustomed to the diminishing volume of air. Were the same degree of obstruction to occur within a few hours or days, the patient would require a tracheotomy as an emergency measure.

In most instances, the diagnosis of these cysts is comparatively simple, although some of them may be confused with other laryngeal lesions.

The treatment of embryonal laryngeal cysts is dependent on their size and condition. If small they may be removed under direct laryngoscopy with the Lynch suspension apparatus, but when of large dimensions they can be exposed and excised only by means of thyrotomy. Patients who are severely dyspneic may require a preliminary tracheotomy before any type of treatment is undertaken. When such a cyst is infected and contains purulent material it may be advisable to incise the tumor under suspension laryngoscopy, and thus allow its fluid contents to be expelled, and its walls to collapse. Frequently, the cavity of the cyst subsequently will become obliterated by the formation of scar tissue. However, if the cyst tends to refill, it can be excised safely after the acute inflammatory reaction has subsided.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Skoog, T.: Post-Traumatic Late Meningitis After Fracture of the Base of the Skull (Zur Frage der posttraumatischen Spaetmeningitis nach Schaedelbasisfraktur). *Acta chir. Scand.*, 1939, 83: 27.

It is difficult to judge the prognosis and insurance-legal aspects of skull injuries, especially shot injuries, as reactivation of the inflammation with late meningitis and possibly death may occur as late as several years after the injury. In civil, i.e., accidental, injuries to the skull, the main and immediate danger is injury to the brain; then, infection threatens, and in open fractures it depends on the participation of the pneumatic cavities about the fractures. Danger of infection from the latter foci decreases with the time elapsed since injury. Late meningitis, i.e., meningitis occurring after an interval of restitution with or without disability, threatens especially if the fracture involves a cavity with a poor tendency of osseous healing of its wall. This is especially the case in fractures severing the os petrosum in a plane about vertical to its axis. Fractures of the anterior cranial cavity and fractures in, or parallel to, the pyramid axis, usually lead to osseous healing. In the cases of late meningitis after labyrinth fracture (about 15 are reported), the time interval was from a few weeks to fifteen years. Many cases may not have been recognized as post-traumatic late meningitis, as only microscopic post-mortem study corroborates the diagnosis, not clinical or macroscopic impression.

Skoog adds the following case:

A man, aged forty-four, suffered a severe blow to the head in a car wreck and was unconscious for a few hours. He was treated at home for concussion of the brain. No bleeding from the nose or ears had been noticed. Intense dizziness and deafness of the right ear occurred soon. The dizziness left after some time, and the man was able to work for a few months and was apparently well except for the deafness. Six months after the accident he was hospitalized for severe and increasing headaches; there was a dimming of consciousness, and marked psychic and motoric restlessness followed within a few hours. Examination showed all the signs of an advanced meningitis with high fever. On spinal puncture, the initial pressure was found to be 400 mm. and there were 20,000 leucocytes per c. mm. in the spinal fluid. A moderate redness of the upper part of the right drum was found. On paracentesis, no fluid was obtained. The left drum was slightly retracted. There was weak vertical nystagmus. With 100 c.cm. of water at 17°C. (62.6°F.) there was no caloric reaction in the right ear, and a normal reaction in the left ear. A diagnosis of post-traumatic late meningitis was made, and a radical operation was done on the right ear (labyrinthectomy plus drainage of the right pons angle cistern) in spite of the advanced meningitis, and Skoog realizes that one may doubt whether the intervention was justifiable. After the usual radical operation with removal of the drum and ossicles, a distinct fracture line was seen on the medial wall of the cavum tympani, extending from the foramen rotundum horizontally toward the anterior parts and disappearing in the aperture of the tube. When Skoog attempted to remove the mucous membrane there, he found it inverted and caught between the fracture margins. Another cleft extends toward the canalis nervi facialis which is bare at that point. On opening the labyrinth in the region of the horizontal duct, one sees that the fracture continues and widens into the depth, creating a wide communication between the horizontal duct and the vestibulum. Then and later firm granulations were found in the cochlea. The dura in the posterior cranial fossa was incised and the pons angle cistern drained. One and one-half days after the operation, the patient died. Post-mortem examination showed a purulent meningitis. No macroscopic evidence of a skull fracture was seen. The right os petrosum was removed *in toto* for microscopic examination which was done mainly around the porus acusticus internus, as this region had remained intact at operation. It was sectioned in a series of horizontal sections, parallel to the axis of the pyramid. While there is much pus present in the labyrinth cavities not destroyed at operation, which gives the definite impression of a communication between the inner auditory meatus and the cochlea, no such fissure can be found in the cribriform wall between these cavities. There are, however, such communicating fissures between the scala tympani and the meatus internus, and between the vestibulum and the meatus internus. While there is much pus in, and not much periosteal reaction around, these fissures, a third cleft extends from the inner meatus into the meatus wall, with good callus formation and without signs of inflammation.

Complete loss of hearing and spontaneous severe vestibular symptoms are constant in pure labyrinth fractures, uncommon in longitudinal pyramid fracture, and rare in concussion of the brain. Thus, a gross lesion of the labyrinth can be assumed in such a case from the history only. An examination in the acute stage would have resulted in the definite diagnosis of a pyramid fracture, as there certainly was a hematotympanum. In the longitudinal fracture of the pyramid, the fracture usually extends to the frame of the drum or even into the external meatus, and thus leads to an external hemorrhage, while the labyrinth (cross) fracture does not produce external hemorrhage except in the presence of an old perforation of the drum. It may lead to a hematotympanum. Thus early expert examination would have resulted in early diagnosis, and x-ray studies would

have been made. The precipitating otitis media does not need to become manifest clinically, and a simple catarrh may suffice to incite disastrous processes. In all cases described so far in the literature, the post-traumatic late meningitis was far advanced when seen first. In spite of the severity of the injury of the author's case and in spite of the fact that the involvement of the facial nerve was manifest macroscopically at operation, clinically no facial lesion had been found which concurred with other authors' findings. In all cases like the present one, a simple radical operation is not sufficient and a labyrinthectomy must be done. The death in this case is to be attributed to the very severe meningitis, not to the intervention, which was, of course, a last resort, undertaken with but little hope for success.

What prophylactic measures can be taken to prevent the outbreak of the almost always fatal late meningitis? Labyrinth fractures are rare: they occur in from 3 to 6 per cent of fractures involving the os petrosum. The total mortality is high: about two-thirds of the patients die from infection in the acute or subacute stage. Most careful supervision of the surviving patients with repeated check-ups of the spinal fluid and otoscopic findings, and immediate active therapy on the slightest sign of reactivation of infection are mandatory.

In the discussion whether a routine active therapy is justified prophylactically in injuries to the petrous bone, Skoog is inclined to advise watchful waiting under otological supervision rather than early labyrinthectomy, as a routine measure, for so long a time as the otologist may deem necessary. Theoretically the possibility of a fatal flare-up exists throughout the entire life of the patient. From the angle of insurance medicine, Swedish laws and rules of private companies provide payment of indemnity if death occurs immediately or not too long after the accident. However, in cases in which the interval is many years, no indemnity would be paid, although pathologically there cannot be any doubt as to the causal connection between the accident and death. As far as acceptance of applications for life insurance after labyrinth fractures is concerned, in the first few years such applicants are as poor risks as persons with skull shot injuries and should be rejected, but after a longer time their acceptance is possible, however at a higher premium than persons without such injuries would pay.

HEINRICH LAMM, M.D.

Davis, L., and Martin, J.: Surgical Lesions of the Paratrigeminal Area. *J. Am. M. Ass.*, 1939, 113: 1952.

After studying a series of 16 cases, all of which presented either a small meningioma within the dural envelope of the gasserian ganglion or an aneurysm of the internal carotid artery, the authors describe a syndrome characteristic in history and physical findings of such lesions situated in the medial portion of the middle cranial fossa, "the paratrigeminal area." The recognition of these lesions is important because (1) they must be differentiated from major trigeminal neuralgia, and (2) operation relieves the patients in at least one-half of the cases.

Pain in any of the three branches of the trigeminal nerve, but always in the ophthalmic, was always present. A "trigger zone" may or may not be present. The pain is less excruciating and less well localized in the face than it is in trigeminal neuralgia. In either type of lesion the innervation of the extra-ocular muscles will suffer, and the motor root of the trigeminal nerve may also be involved. In the case of gasserian-ganglion meningiomas, there are invariably patchy areas of facial hypesthesia or anesthesia. A Horner's syndrome with absence of the ciliospinal reflex is usually seen in cases of paratrigeminal aneurysms. Also, in the presence of an aneurysm the oculomotor nerve is more frequently and extensively involved than are the nerves to the other extra-ocular muscles. The pain of an aneurysm is not so nearly like that of trigeminal neuralgia as is that produced by a meningioma within the dural envelope. The prognosis for full recovery in the cases of paratrigeminal aneurysm has been generally poor but, on the contrary, in the cases of tumors, successful removal has been effected with good recovery.

SYMPATHETIC NERVES

Keeney, E. L.: The Medical and Surgical Treatment of Severe Bronchial Asthma. *Bull. Johns Hopkins Hosp., Balt.*, 1940, 46: 34.

Patients with severe bronchial asthma may be divided into 3 groups: (1) patients with severe acute bronchial asthma, (2) patients with intractable asthma (status asthmaticus), and (3) patients with severe chronic bronchial asthma.

Patients with severe acute asthma should first receive from 0.3 to 0.5 c.cm. of epinephrine hydrochloride (1:1000), which may be repeated every fifteen minutes until 4 doses have been taken. To prevent recurrence, an intramuscular injection of from 0.75 to 1 c.cm. of epinephrine-in-oil should follow. One of the barbituric-acid derivatives may be employed as a sedative. If the patient is badly in need of rest, an injection of from 0.3 to 0.5 c.cm. of Schlesinger's solution is usually effective. (One-half cubic centimeter of Schlesinger's solution contains 0.000125 gm. of scopolamine hydrochloride, 0.01 gm. of morphine hydrochloride, and 0.015 gm. of dionin.) Hypertensive patients with asthma may be treated with epinephrine.

Patients with intractable asthma fail to obtain relief from the usual epinephrine preparations. The intravenous injection of 100 c.cm. of 50 per cent sucrose to which has been added 0.5 c.cm. of epinephrine hydrochloride, or the injection of 0.48 gm. of aminophyllin diluted in 10 c.cm. of normal salt solution, may give temporary relief. The continuous or intermittent inhalation of 100 per cent oxygen, or of 80 per cent helium and 20 per cent oxygen, is of help. Rapid digitalization should be instituted and a maintenance dose of digitalis given until there is

freedom from asthmatic symptoms. Sixty to 120 c.cm. of a mixture of equal parts of ether and olive oil may be instilled rectally to induce sleep. Opiates are contraindicated as they depress the respiratory center.

Patients with severe chronic bronchial asthma require frequent injections of epinephrine hydrochloride. Relief in from eight to sixteen hours may be obtained by an intramuscular injection of epinephrine-in-oil. The value of intratracheal injections of iodized oils is generally overrated.

There is a small group of patients with chronic bronchial asthma who fail to obtain relief from any method of medical treatment. For this group the following operations have been advocated by various surgeons: Unilateral sympathectomy, unilateral ganglionectomy, unilateral vagotomy, and unilateral and bilateral posterior pulmonary plexectomy. On purely physiological consideration, the author is of the opinion that bilateral posterior pulmonary plexectomy should offer the best result.

DAVID J. IMPASTATO, M.D.

MISCELLANEOUS

Nowak, S. J. G.: Chronic Hypertension Produced by Carotid-Sinus and Aortic-Depressor-Nerve Section. *Ann. Surg.*, 1940, 111: 102.

Impressed by the uncertainty of the results of previous authors who attempted to produce chronic hypertension by the carotid-sinus and aortic-depressor-nerve section technique, Nowak studied a series of 23 dogs, 16 of which had undergone bilateral denervation by the Hering-Heymans method of operation. Other animals were prepared unilaterally and studied for the effects of cerebral anemia alone, or were prepared by a technique which left the carotid artery and its branches intact. Denervation was accomplished by excision of both common carotid bifurcations with the intervening plexus (carotid-sinus nerve), and by the excision of from 1 to 2 cm. of the aortic depressor nerve lying in the vagal sheath.

In 10 of the 16 dogs chronic hypertension, with pressures averaging over 180 mm. (this being the minimum hypertensive requisite), was produced; some of the animals showed pressures which were much higher than this. The maximum duration of this hypertension was three and one-third years, which left no doubt as to the chronicity of the condition. Fluctuations of pressure were observed: 4 dogs showed only transient, or no hypertension; inanition was taken to be the cause of remission in 2 animals. One dog, with unilateral denervation, returned to normal after having had hypertension for seven and one-half months. In 3 dogs the carotid sinus was denervated and the aortic depressor nerve was excised, the carotid bifurcation being left intact; none of these animals developed a pressure higher than 166 mm., and in all it leveled off in a short period to approximately 154 mm. This result was considered to be due to incomplete denervation afforded by this method.

The cerebral anemia effects were believed to play no rôle in the hypertension which had been produced successfully in these animals. In one dog the advent of pregnancy did not appreciably alter the hypertension. In all animals a tachycardia occurred, which varied directly with the blood pressure. In no animals were there changes in the blood carbohydrates, fats, chlorides, calcium, oxygen, carbon dioxide, cell volume, or red-cell count. Urinalyses were generally normal.

From these facts it is assumed that in hypertension produced in the manner described there is no chemohumoral factor, and the lack of change in cell volume rules out blood viscosity as a cause. The author concludes that hypertension produced by the Hering-Heymans operation is chiefly neuroconstrictive in nature.

JOHN MARTIN, M.D.

SURGERY OF THE THORAX

CHEST WALL AND BREAST

Desjacques and Clert: The Treatment of Wounds of the Chest (Le traitement des plaies de poitrine). *Mém. l'Acad. de chir.*, Par., 1939, 65: 1171.

In open wounds of the chest made by a knife or revolver bullet, Desjacques and Clert recommend immediate surgical operation and exploration to determine the extent of the injury and repair of such structures or organs as have been damaged. In one of the cases reported, a knife wound in the lung was sutured, no damage to the large blood vessels having occurred. The wound was closed without drainage; a small hemothorax developed which was gradually absorbed, and the patient made a good recovery. In such cases, the authors note, the resulting hemothorax is usually small and is absorbed, puncture not being necessary.

In open or closed wounds of the thorax, surgical exploration is necessary if the wound is in the precordial region, when there may be damage to the heart, or in the region of the large thoracic blood vessels that may be injured. When the wound is at the base of the thorax, there may also be damage to some of the abdominal organs, which is more serious than any injury to the thoracic structures. If there are no signs of abdominal injury in these cases, the thoracic wound should be explored; there may be a lesion of the diaphragm or the pleura, or both, which can be repaired by suture. When signs of abdominal injury predominate, a laparotomy should be done; the condition of these patients is usually too serious to permit a prolonged operation and exploration of the thorax. The patients should be kept under careful observation for some time in order to determine whether any lesion of the diaphragm develops or persists.

In any case, wounds due to a revolver bullet are more dangerous than those due to a knife; in the former, operation to remove the bullet may be necessary; in the latter, if the wound is not in one of the dangerous zones noted above, operation is not necessarily indicated except for verification of the course of the cut and hemostasis. The hemothorax that results from any chest wound may be absorbed; in some cases puncture is necessary to remove the collection of blood. Infection and suppuration of the hemothorax are rare, but may occur; one such case is reported in which pleurotomy was necessary; the patient made a good recovery.

In other cases, in which the patient seems to be recovering satisfactorily from the wound, signs of pleural effusion develop, with or without a considerable rise in temperature. This is due, not to an extension of the hemothorax but to the formation of clots which irritate the pleura with a resulting hyper secretion of pleural fluid. In such cases pleurotomy for complete removal of the clots and the collected fluid is necessary; repeated punctures are not sufficient; if suppuration develops rib resection may be necessary.

Twenty-four cases are reported, illustrating the various types of thoracic wounds and the treatment employed. These, the authors note, were all wounds of civil life, not war wounds, which are more often produced by large artillery shells and require different treatment. ALICE M. MEYERS.

Hicken, N. F.: Mastectomy: A Clinical Pathological Study Demonstrating Why Most Mastectomies Result in Incomplete Removal of the Mammary Gland. *Arch. Surg.*, 1940, 40: 6.

Simple mastectomy is an operation frequently attempted but seldom accomplished. Studies made on all breasts removed at several large hospitals over a three-year period indicate that almost invariably the breast is incompletely removed in simple mastectomy.

Embryologically the breast represents a modified sebaceous gland. It is composed of from 15 to 20 lobules, each of which has a separate ductal opening on the nipple. Usually, only 6 or 8 of these lobules are well developed. Accurate anatomical patterns of the lactiferous ducts can be readily obtained by means of roentgenographic studies with a contrast medium. From a study of 385 mammograms, it is evident that the ducts are widely distributed over the entire anterolateral aspects of the thoracic cage. In 95 per cent of cases the ducts ascend into the axilla. In some instances the ducts extend into the epigastric space, or across the midline, or else follow the lateral chest wall beyond the anterior border of the latissimus dorsi muscle. The possible ramifications of the breast are indicated in Figure 1. Very frequently the ducts come in intimate contact with the overlying skin.

Evidence to confirm the author's impression that simple mastectomies usually resulted in incomplete removal of the breast was easily obtained by injecting methylene blue into each ductal opening of 17 breasts removed at operations. In 94 per cent of these cases the dye escaped into the subareolar zone, which indicated that breast tissue had been left attached to the skin. In 88 per cent of cases the axillary segment was incompletely removed, the sternal extension in 23 per cent, and the epigastric ramification in 11 per cent. In 75 per cent of all cases there were multiple areas of incomplete removal. The author points out the danger of incompletely removing the breasts, in that carcinoma or other diseases may occur in the residual tissue. He reports 2 such cases.

In order to assure a complete removal of breast tissue with a simple mastectomy, a simple technique has been devised. The breast is prepared as for a radical mastectomy. Two patent estuaries in each

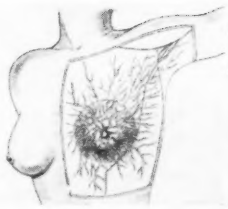


Fig. 1

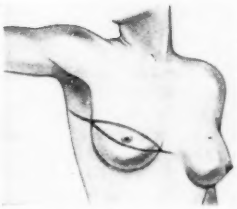


Fig. 2

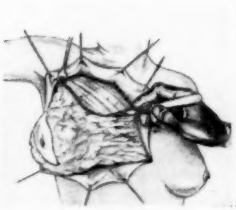


Fig. 3

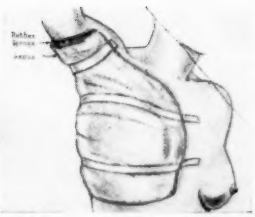


Fig. 4

Fig. 1. Composite schematic drawing representing the ramifications of the lactiferous ducts over the anterolateral chest wall. Note the axillary, subpectoral, midsternal, and epigastric extensions. These were all seen by mammographic studies.

Fig. 2. An oblique mastectomy incision which gives adequate exposure without leaving scars that will show.

Fig. 3. Manner of dissecting the breast from the pectoral fascia. Note the axillary and epigastric extensions of mammary and adipose tissue.

Fig. 4. Compressive rubber sponge dressings employed to keep the skin flaps in intimate contact with their nutritional bed.

quadrant of the nipple are cannulized and injected with methylene-blue solution. The dye accurately outlines the ramifications of the breast and if the surgeon keeps beyond the "blue zone" a complete mastectomy is assured.

An oblique incision (Fig. 2) is advocated, since it can be made long enough to expose the axilla and the lower end will not be exposed when low-necked dresses are worn. The skin flaps are dissected with extreme care, and should remain close to the skin. A wide denudation is made in order to expose all breast tissue in the axilla, epigastric notch, over the sternum, and the anterior border of the latissimus dorsi. Dependent counterdrainage is used to overcome serum collection, and large rubber-sponge pressure dressings, held in place by adhesive strapping, favor the maintenance of viable skin flaps. Early passive exercises are instituted postoperatively.

LUTHER H. WOLFF, M.D.

TRACHEA, LUNGS, AND PLEURA

Vaccarezza, R. F., and O. A., and Médici, F. A.: Transparietal Aspiration of Tuberculous Lung Cavities (Aspiración transparietal de las cavernas tuberculosas del pulmón). *An. de la cátedra de patol. y clin. de la tuberculosis*, 1939, No. 1, p. 67.

Transparietal emptying of tuberculous cavities of the lungs follows the old aphorism: ubi pus, ibi evacua. The first case treated in this way was published in 1845 in France. While the discovery of the roentgen rays and of the principles of asepsis aided somewhat, these operations had a very high mortality. These operations, and also those of classic chest surgeons, such as Sauerbruch, Lilienthal, Tuffier, and J. Alexander, were done to secure drainage, and required a wide opening. In 1937, Eloesser of San Francisco reported on 2 cases of closed cavities in which he secured drainage by means of a rubber drain inserted transparietally through a trocar. Another report, of obviously excellent immediate results, was published in 1938 by Monaldi from the Istituto Forlanini in Rome, Italy.

The authors report 4 cases of transparietal drainage of tuberculous cavities of the lungs.

The first case was that of a man, aged forty-four, who had an extended cavity in the upper and middle part of the right lung. On July 10, 1936, aspiration of 10 c.cm. of yellowish-green pus, in which there were abundant Koch bacilli, was performed. Two days later, 60 c.cm. of pus were aspirated, and five days later 100 c.cm. were removed. The cavity was washed with weak Lugol's solution and reaspirated. On September 2, 1936, there was aspiration of air and liquid. After the third aspiration, there was marked clinical and roentgenological improvement, affirmed by a roentgenogram taken fifteen months after the beginning of treatment. The patient regained his ability to work and is in a state of apparent clinical cure.

The second case was that of a housewife of twenty-seven years, first seen January 19, 1939. She had a history of tuberculosis of seven years' duration. Phrenicectomy on the right side had been done in 1934. There was an extended cavity, the maximal diameter of which was 6.5 cm., in the right lower and medium field. Abundant sputum, subfebrile to febrile temperature, and loss of weight were observed, and the tests were positive for Koch bacilli. On March 24, 1939, under local anesthesia, an incision was made in the eighth right interspace in the midaxillary line, and a 6 mm. trocar was inserted. Through an inserted thoracoscope, one could see the irregular walls, the drainage bronchus, and the accumulation of pus in the cavity. A Nélaton catheter 14 F. was inserted and 44 c.cm. of pus were aspirated. The trocar was removed, but the catheter was left intact, fastened to the thoracic wall; Buelau's syphon drainage was then instituted. Because of pain and fever the catheter had to be removed a week later. On May 4, 1939, the tube was re-inserted and alcohol was injected into the seventh intercostal nerve. This was followed by improvement, and there was no untoward reaction. Roentgenography showed a very distinct reduction in the size of the cavity.

The third case was that of a man of twenty-five years, with a specific history of many years' duration; he had a giant cavity in the upper and middle part of the left lung. He was treated like the patient in Case 2, but after suction for twenty-five days there was no roentgenological change, although some clinical improvement was noted.

The fourth case was that of a woman, aged twenty-five, with a relatively short specific history; she had a cavity in the upper part of the left lung, the maximal diameter of which was 7 cm. Treatment as in Case 2 was tolerated fairly well, and led to marked clinical improvement, and on planigraphic examination, the cavity was found to have shrunk to 1.5 cm. in diameter.

In the third case manometric studies had shown that there was free communication between the cavity and the bronchial tree; in this case the method failed, while in Cases 2 and 4, in which it succeeded, there must have been no communication, or only a partial one, between the cavity and the bronchus. This conjecture was confirmed by manometric studies.

The transparietal aspiration treatment of pulmonary cavities does not seem to be dangerous if carried out through areas where the visceral pleura adheres to the wall and when the prevalent organism in the pus of the cavity is Koch's bacillus. On the other hand, aspiration of putrid, gangrenous, or highly virulent pus from the lung cavity often is followed by severe thoracic cellulitis. Pleural adhesions are not only a necessary requirement to permit safe institution of this method but also its main indication, as they render the artificial pneumothorax treatment impossible. The method is limited to cavities with prevalently positive pressure, an indication of the absence of satisfactory communication with the bronchial tree. Cavities in the lower parts of the lungs are especially amenable to this method. HEINRICH LAMM, M.D.

Raquet, B.: A Report of the Results of Thoracoplasty after One Year (Bericht ueber die thorakoplastischen Operationen des Jahres 1934, nach dem Stand vom 1. Januar 1936). Leipzig: Georg Thieme, 1939.

This report gives the immediate results and the results after a year, of thoracoplasty, together with a detailed collection of illustrative cases. It helps to answer the questions as to how far the operative method of treatment can bring an open primary case of cavernous tuberculosis to a complete cure and as to which cases will be permanently cured.

After a short résumé of the literature, the author reports the results in 76 cases. The total mortality was 26.3 per cent, 20 patients. The collapse operation was done in open tuberculosis. Nineteen (26.7 per cent) of the patients died; 3 could not be followed up. In 36, or 72 per cent, the cavity closed and in 14, or 28 per cent, it remained open. Twenty-two, or 44 per cent, of the patients returned to their professions; 15, or 30 per cent, are doing light work; 3, or 6 per cent, were rehabilitated in a new profession; 6, or 12 per cent, are still in a sanitarium under treatment; and 4, or 8 per cent, are unable to work. Of 4 patients treated by plastic operation for empyema, 3, or 75 per cent, presented closed cavities; 1 patient died twenty months after the operation of chronic suppuration because he was not co-operative and left the hospital several times against advice. Careful observations were made with the respirometer and the electrocardiograph for their prognostic value.

An improvement of the operative mortality has been achieved by systematic tests to show whether the cases are suitable for operation, by modifications of treatment, and by further development of the operative technique. The delayed mortality, that is, later than four weeks after operation, is influenced by further development of the disease in cases operated upon too late. The significant factor, therefore, is the choice between too early an operation with stormy, dangerous, allergic reversal and too long waiting with its increased late mortality. It is recommended that in favorable conditions, after exhaustion of the conservative methods of treatment and of conservative forms of collapse therapy, thoracoplasty be done before degenerative damage of the parenchymatous organs occurs. (HEINEMANN-GRUEDER). FREDERIC W. ILFELD, M.D.

Neuhof, H., and Copleman, B.: Interlobar Perforated Abscess of the Lung (Interlobar Empyema). *Surgery*, 1940, 7: 236.

The authors present 16 cases of proved interlobar suppuration, collected from 650 cases of empyema treated at Mount Sinai Hospital in the past ten years. Contrary to the accepted belief, the collection of pus between the lobes of the lung was the result of perforation of a pulmonary abscess immediately beneath an interlobar surface. In 13 of the 16 cases the pus was putrid.

The clinical manifestations are not distinctive. They suggest a pneumonic lesion with fever, cough, and pain. Expectoration of foul pus occasionally occurs. The clinical course is likely to be chronic and the diagnosis difficult.

The most distinctive findings are the roentgenographic appearances of the lesions. In one-half of the cases the findings are characteristic; in the other half the distinctive characteristics may be obscured. The roentgenological criteria from which a correct diagnosis can be made are: an interlobar collection of fluid or of fluid and air, a fluid level on or near a fissure, an alteration in the shape of a fissure, and progression of disease along a fissure.

Not only is the lesion most likely to be diagnosed by means of the x-rays, but its exact location may be determined. This is a great help in making exploratory punctures and guides the surgeon in planning his operative procedures.

Since the surgeon is draining a pulmonary abscess and not an empyema, the operative procedure should be based on that fact. If adhesions are not present at the site of drainage, a two-stage procedure should be

employed. The interlobar space should be opened widely, the underlying abscess looked for, and opened, and the whole cavity should be packed with gauze.

The mortality in interlobar ruptured abscess of the lungs is not referable apparently to the nature of the lesion, but to prolonged delay in diagnosis, erroneous roentgenological interpretation and, above all, operative treatment which does not take into account the causative pulmonary abscess, or which results in infection of the free pleural space.

JULIAN A. MOORE, M.D.

Nylander, P. E. A.: Tuberculous Empyema (Zur Frage der tuberkulösen Pleuraempyeme). *Acta Soc. med. Fennicae Duodecim*, 1939, Ser. B., 27: Fasc. 1–2.

Although acquiescing with the long established principle that sterile, cold empyemas should be managed for the most part without surgical intervention, the author believes that this conservatism should not be carried too far. Of the 95 cases recorded in his article, 41 eventually came to operative treatment. Many of them, of course, presented superimposed pyogenic infections. Twenty-one patients were subjected to thoracoplasty while 20 were treated by a mere thoracostomy. There are a multitude of cases which may appear to be hopeless in the beginning, but nevertheless through effective drainage become suitable for thoracoplasty. Of the 29 patients treated by thoracoplasty, 5 were lost. Two of them died before all of the operative stages could be completed and 3 of them succumbed from two to three years after operation. Of the 17 living, 8 have been well for three years; 2 are bacilli-free but otherwise little changed; and the remainder have been observed for a period of less than three years. In 5 cases, myoplastic procedures were added to the thoracoplasty to eliminate a fistula.

It is believed that the series demonstrates that the result of operative treatment is not too bad. One should not, therefore, aimlessly persist in conservatism if the fluid shows no diminution or if the pulmonary condition *per se* requires radical collapse therapy.

FRANK MCDOWELL, M.D.

HEART AND PERICARDIUM

Strieder, J. W., Clute, H. M., and Graybiel, A.: Cardio-Omentopexy in the Treatment of Angina Pectoris. *New England J. Med.*, 1940, 222: 41.

The authors review briefly experimental and clinical data dealing with the subject of improving the collateral circulation of the heart muscle following occlusion of the coronary arteries.

Clinically, there have been two methods of revascularization of the ischemic heart in the human subject. Beck has been successful in bringing a new blood supply to the heart by means of a pedicled graft of the pectoralis major muscle. Using omentum instead of muscle as the revascularizing graft, O'Shaughnessy was similarly successful.

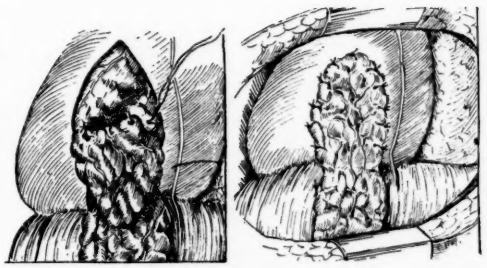


Fig. 1. The surface of the omentum being sutured to the myocardium with multiple silk sutures, avoiding the branches of the coronary vessels. The drawing on right shows the suturing of the graft to the myocardium completed. Note the cut edges of the pericardium sutured to the omental graft in order to encourage further vascular anastomosis.

Because of various considerations, the authors feel that the omentum is a better vascularizing agent than the pectoralis major muscle, and have successfully performed cardio-omentopexy in 2 cases.

There are as yet no hard and fast indications for the selection of cases for this operation. The authors believe that certain definite requirements must be met before a case is suitable for operation. In so far as it is possible to determine there must be, first, indisputable evidence of coronary heart disease with angina pectoris. The patient must be under sixty years of age and not obese. Serious complications in other organs are, of course, contraindications. The patient must not have marked hypertension and cardiac enlargement. Also, patients who give evidence of congestive failure are not suitable candidates for operation.

The following is the technique of operation as performed by the authors:

For several days prior to operation the patient receives 3 gr. of quinidine sulfate three times daily, in order to reduce the irritability of the heart. Morphine sulfate is given in suitable doses preoperatively. After induction of anesthesia with ether vapor and oxygen, an intratracheal tube is introduced and connected to the anesthesia machine, in a closed system, so that differential pressure may be used.

The patient is placed in the dorsal recumbent position and an incision is made over the fifth left intercostal space extending from the midsternal line to the anterior axillary line. The left pleural cavity is entered through the fifth interspace, and after the fifth and sixth cartilages have been divided at the chondrosternal junctions the Sauerbruch rib-spreader is placed. The left lung, if free of adhesions, will drop posteriorly as it collapses and allow an ample view of the pericardium.

The phrenic nerve is identified on the pericardium and crushed lightly for the width of a hemostat. This causes the left hemidiaphragm to come up into view.

An opening 5 cm. long is then made through the diaphragm in the direction of its fibers, reasonably close to the pericardium. Through this opening the fingers deliver a suitable piece of omentum for attachment to the heart muscle. It is desirable that the omentum be pulled up until its lower margin can be obtained, and not grasped near the colon. Care must be used that undue tension on the transverse colon is avoided. The colon must not enter or encroach on the diaphragmatic opening.

When sufficient omentum has been delivered through the diaphragm to cover the area of myocardium to be grafted, steps must be taken to close the diaphragm about the omentum and to prevent a later herniation of the abdominal organs into the pleural cavity. In each of their cases the authors placed many interrupted silk sutures about the opening in the diaphragm in order to include the omentum and shut off the pleural cavity.

The pericardium is next opened, and the omental graft is sutured to the heart muscle with interrupted silk sutures placed over its flat surface. The graft should be placed so as to overlap the branches of the right and left coronary vessels. Care must be taken to include no branches of the coronary vessels in the sutures. It is of great importance to avoid penetrating the entire wall of the ventricles.

When the omentum is widely covering the left lateral aspect of the ventricles, its edges are sutured to the cut edges of the pericardium and also to the inferior pericardiosternal ligament.

The lung is next re-inflated and the wound in the chest wall is closed in layers in the usual air-tight manner, with interrupted perichondral braided-silk sutures. At the conclusion of the operation, as in any intrathoracic procedure, it has been the authors' practice to insert a needle and withdraw any trapped residual air from the pleural cavity, and thus adjust the inspiratory and expiratory pressures to their normal negative levels.

In the 2 cases reported by the authors, there was no operative mortality. The first patient, however, died six months after cardio-omentopexy as a result of the repair of a diaphragmatic hernia which had developed postoperatively. Following the primary operation he had had great relief from pain, required no drugs, and showed a marked improvement in exercise tolerance.

The second patient has now lived for thirteen months since operation. He still has pain, which is less severe and requires some medication, and has a greatly improved exercise tolerance. According to O'Shaughnessy, improvement may be expected for from twelve to eighteen months after operation.

The authors state that many more patients must be operated upon before any sweeping conclusions may be drawn, but on the basis of the work already done they are encouraged to believe that the principle of revascularization is sound. At the present time, they believe that we should be concerned with establishing the fact that an adequate blood supply can be brought to the heart, regardless of the method used. When this has been definitely shown to be possible and physiologically efficient in the human subject, the method will become important.

SAMUEL H. KLEIN, M.D.

Bigi, S.: Purulent Pericarditis in Intrathoracic Infections (La pericardite purulenta nelle infezioni intratoraciche). *Ann. ital. di chir.*, 1939, 18: 876.

Statistical studies indicate that the incidence of suppurative pericarditis has increased. In more than 14 per cent of the deaths due to pneumonia there was an associated pericarditis. Among 7,965 autopsies Pyroh and Pain found 214 cases of acute pericarditis. Among 113 cases of pericarditis reported at the Mayo Clinic there were 77 of suppurative pericarditis, 30 of fibrous pericarditis, 3 of tuberculous pericarditis, and 3 of non-inflammatory pericarditis.

The pneumococci were found to be the most common bacteria. Bisgaro reported the following incidence: pneumococci, 45 cases; streptococci, 23 cases; and staphylococci, 17 cases. The male sex was more frequently affected than the female, the ratio being 2 or 3 to 1. Young people, usually in the middle twenties, seemed to be the most susceptible. In the majority of cases suppurative pericarditis occurred as a complication of intrathoracic infections such as pneumonia or pneumonic pleuritis with empyema and complicating pericarditis. Among the 77 cases of suppurative pericarditis reported from the Mayo Clinic there was intrathoracic infection in 57, and sepsis in 20. Empyema was present in 28 cases; in 11 of these there was an associated bronchopneumonia, and in 2 a lobar pneumonia. Bronchopneumonia without empyema occurred in 10 cases, acute pleurisy in 5, and pulmonary abscess in 4.

The primary type without an obvious portal of entry was rare. There were cases of pericarditis described after other infections. Bisgaro in 1931 reported 17 after trauma; 18 after osteomyelitis; 7 after otitis and angina; 3 after puerperal sepsis; and 77 after thoracic infections. Of the latter, 47 were associated with pneumonia, 21 with pulmonary suppuration, and 9 with empyema.

The author reports that in the last two years he has observed at the Bologna Surgical Clinic 8 cases of suppurative pericarditis; 5 after pneumonia with complicating empyema, and 3 after chronic pulmonary suppuration.

The author reports in detail on 2 patients from the former group.

The first was a fifty-year-old man, who became ill with bronchopneumonia twenty-five days previous to admission. He developed marked dyspnea. X-ray examination demonstrated empyema on the right side with displacement of the heart to the left. Aspiration yielded turbid yellow pus containing Gram-positive, encapsulated diplococci. Rib resection was performed and drainage instituted. After a temporary improvement the patient gradually

became worse and died eight days after surgical drainage of the empyema. Suppurative pericarditis was suspected. Autopsy revealed an empyema with multiple sacs in the right side of the thorax. One of these sacs had not opened or drained and was in the right paramediastinum. Suppurative pericarditis had been present and 120 c.cm. of purulent material containing pneumococci and diplococci had collected.

The second case was that of a thirty-three-year-old man upon whom a radical mastoidectomy had been performed one month previously. Two days later an acute tonsillitis with high fever had developed. A week later pneumonia was present on the right side. Empyema occurred and aspiration was done twice, with the removal of 200 c.cm. of pus each time. Resection and drainage were then performed for the empyema. However, a marked tachycardia developed; the heart tones became distant. Pericardial friction rub was noted to the right of the sternum. X-ray examination showed pneumothorax on the right side with collapse of the lung.

At autopsy the right lung showed a thickened pleura and suppurative bronchopneumonia. The pericardium contained from 60 to 70 c.cm. of pus, while the myocardium was normal.

The author further discusses the literature in detail. He states that puncture, incision of the pericardium, and pneumopericardium in animal experiments have resulted fatally with arterial hypotension, arrhythmia, and cardiac arrest. However, the treatment is surgical. The prognosis depends on early diagnosis, the bacterial nature of the infection, and the nature of the original intrathoracic infection.

JACOB E. KLEIN, M.D

SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Smith, C. H., and Masson, J. C.: Results of the Repair of Ventral Hernias with Sutures of Fascia Lata. *Surgery*, 1940, 7: 204.

The recognition of a need for a more satisfactory suture material for use in certain plastic operations, the authors believe, has been evidenced by the number of instruments devised for the obtaining of fascia lata for sutures.

Masson designed his fascia stripper in 1933 and has used it without modification since that time.

TECHNIQUE

In the repair of ventral hernias as performed for this series of patients the principles laid down by Gallie and LeMesurier were used. The aponeurotic surfaces were denuded of areolar tissue. No attempt was made to isolate the various layers of the abdominal wall. When possible, the entire thickness of the abdominal wall, except the skin and subcutaneous fat, was overlapped according to the method described by W. W. and W. J. Mayo. To save time and to make as accurate a closure of the peritoneal cavity as possible, a single strand of No. 1 chromic catgut was used to approximate the upper surface of the fascia from one side of the wound to the under or peritoneal surface of the other side, with as much overlap as possible without undue tension.

Strips of fascia lata used as suture material were then used further to fix the upper layer to the under layer of the overlapped abdominal wall. It is advisable, the authors think, to carry some of the "living sutures" from strong normal tissue on one side across the weakened portion to the normal tissue on the opposite side. Sutures should also run at right angles to the transverse sutures.

The number of fascial sutures used in any given hernia depends, first, on the length of the individual sutures, and, second, on the size of the hernia. As a rule, sutures from 8 to 12 in. (approximately 20 to 30 cm.) in length can be obtained from the thigh and, again as a rule, from 50 to 100 in. (approximately 127 to 254 cm.) of fascial suture material should be used for large hernias.

Several technical points which the authors have found valuable in the repair of hernias with fascial sutures might be stressed. An effort should be made to bury as much of the fascia as possible, and thereby afford maximal contact between the fascial sutures and the aponeurotic and muscular portions of the abdominal wall. Whenever possible, the fascial sutures should be anchored by stitching through the fascia of a previous suture. The tendency of the authors is to use more fascial material in the repair of a hernia than they did previously. They have had no experience with the many-tailed flaps of fascia lata which Gallie recommends in preference to fascial sutures in the repair of large hernias.

Use of the Masson fascia stripper proved to be an easy and successful means of obtaining fascia lata for sutures. Legs from which fasciæ have been taken have caused no difficulty either immediately after operation or from two to five years later. No hernias of muscle have been seen. As much fascia as is needed can be obtained; the fascia of both thighs can be made available with no inconvenience in draping the patient. Usually, enough fascial material can be obtained for the repair of a difficult hernia by introducing the fascia stripper once.

The majority of Masson's and Smith's patients who had recurrence of a hernia following the use of fascia lata as suture material were patients for whom a comparatively small amount of suture material was used. The fascial sutures were anchored often by suturing through previous sutures. When the size of the hernia rendered it impossible to overlap the abdominal walls, either the edges of the defect were approximated by fascial sutures or the defect was "darned-in" as a seamstress darns a stocking. Silkworm sutures were used to prevent tension on the fascial repair during healing. The skin was closed with a continuous suture. Soft rubber drains were often used because of the large raw surface resulting from the repair of the hernia.

The patients represented in the series were operated on by Masson during the years 1933 to 1936, inclusive, and the hernias they had presented the most difficulty at operation of 299 ventral hernias repaired at the Mayo Clinic during the aforementioned period.

One patient had an incisional hernia at the lower sector of the midline and also another in the right side of the lower portion of the abdomen, which explains why 85 hernias afflicted only 84 patients. Four patients were more than seventy years of age. The average weight of 184 lb. (approximately 84 kgm.) per patient indicates the type of patient that comprised this series of cases. Twenty-five of the 84 patients weighed more than 200 lb. (approximately 91 kgm.).

Sixteen of the hernias had been repaired from one to five times previously. A few of the hernias were as small as 2 in. (5 cm.) in diameter, but most of them were large. In the clinical records, the hernias were often described as being "one-half the size of a watermelon," or "the size of a football or volley ball."

Because of the large size of the hernias and because many of them had been repaired previously, it was not possible to determine the type of incision through which the hernia had occurred.

Only 1 patient did not receive a spinal anesthetic. For 37 patients it was necessary to supplement spinal anesthesia with inhalation or intravenous anesthesia

because the location of the hernia or the length of time necessary to repair it rendered a dose of spinal anesthetic that would be adequate, unsafe.

An average of 43 in. (approximately 110 cm.) of fascia-lata sutures per hernia was used. The greatest length of fascia-lata sutures used for any 1 hernia was 100 in. (approximately 254 cm.). All leg wounds healed by primary intention. No patient made any complaint of discomfort in the leg postoperatively.

Four of the 5 postoperative deaths were the result of pulmonary complications. The increased intra-abdominal pressure and the resulting decrease in vital capacity, the authors point out, are important factors in the postoperative welfare of patients who have undergone repair of ventral hernias. Frequently it is necessary to place the patient in an oxygen tent immediately after operation has been performed.

In 1 case in which death was assigned to shock, subtotal hysterectomy, bilateral salpingo-oophorectomy, and appendectomy were performed at the same time the hernia was repaired.

The phlebitis of 1 of the 2 patients who had postoperative saphenous phlebitis occurred in the same leg from which the fascia had been taken. There was no evidence that the removal of the fascia was referable to the phlebitis.

One patient whose transverse colon had been opened during the operation was afflicted by a fecal fistula which healed spontaneously. This patient's hernia was cured.

A soft rubber superficial drain was used in the treatment of 51 of the hernias.

There was no complaint concerning the leg in any case. No hernias of muscle were noted. On examining the thighs of patients in this series, a distinct groove where the fascia had been removed could be palpated.

The authors conclude that ventral hernias which they have not been able to repair previously can be repaired with sutures made of fascia lata.

Clute, H. M., and Anglem, T. J.: Gas-Bacillus Infection of the Abdominal Wall. *New England J. Med.*, 1939, 221: 647.

Infection by clostridium welchii has been reported following nearly every type of abdominal operation, although it is more frequently encountered in crushing injuries of the extremities, with or without fractures. In the abdominal wall this infection occurs most frequently after operation for gangrenous appendicitis and decompression of intestinal obstruction. Nine cases from the literature, in which the gas-bacillus infection followed some type of enterostomy, are mentioned. Eight of the patients died. Clostridium welchii is a usual inhabitant of the intestinal tract, and in the presence of intestinal obstruction its growth and production of exotoxin are aided by the presence of slightly alkaline, static intestinal contents and the relative anoxemia of the distended loop.

Diagnosis must be made early for successful treatment. The fulminating type of this infection is accompanied by high pulse and respiratory rates, prostration, and even delirium, usually coming on within thirty-six hours postoperatively. Locally the skin is dull and coppery, and on probe of the wound a thin watery discharge with a characteristic mousy odor is released. The classical crepitus and tenderness are the most reliable and may be the earliest signs. Another type of onset occurs at the end of the first week. General toxicity is less and the characteristic local signs develop slowly. Wound smears and anaerobic cultures will establish the diagnosis, but institution of vigorous treatment methods should not await the outcome of such laboratory procedures.

Local treatment should include wide opening of the wound down to the peritoneal suture line, with débridement of the necrotic fascia and muscle, a constant dressing loosely applied and soaked in hydrogen peroxide, and counter-incisions only for definite abscess. Polyvalent gas-bacillus antitoxin should be given at once and administered vigorously. The authors prefer the intravenous route, and a dose of from 3 to 4 ampules (90 to 120 c.cm.) a day in the fulminating cases, or from 2 to 3 ampules in the milder type of case. Administration should be continued until the infection is obviously controlled, which may mean more than a week. Sulfanilamide is suggested only as an adjuvant; the authors have had no personal experience with x-ray therapy. The authors report the cases of 2 patients who survived after vigorous treatment with polyvalent serum and free surgical drainage. JOHN L. POOL, M.D.

Jonas, R.: Pneumococcic Peritonitis (Ueber Pneumokokkenperitonitis). *Zentralbl. f. Chir.*, 1939, p. 2102.

This disease is not as well understood as it should be. The results in the series of cases seen in the Children's Hospital during the years from 1928 to 1938 are about the same as in the series from 1912 to 1927. In the first period 12 of 31 died (38.7 per cent). In the second period 23 of 59 died (38.9 per cent). Of those subjected to early operation 75 per cent died in the first period and 69.2 per cent in the second. When delayed operation was carried out the results were 28 and 30.4 per cent, in the first and second periods respectively. In the total series of 90 cases operated upon soon after admission, the mortality was 72.1 per cent as compared with 29.2 per cent in the series treated conservatively or by delayed operation. By early operation, the author means that the procedure was carried out within forty-eight hours. The diagnosis was erroneous in 27.5 per cent of the cases in the first period and 22 per cent of those in the second. The results are better, however, as only those cases in which definite bacteriological or autopsy confirmation of the diagnosis was available are considered. Most of the patients are young girls. The differential diagnosis is usually difficult. The following table gives the distinguishing features of the disease:

ACUTE APPENDICITIS	PNEUMOCOCCIC PERITONITIS
1. Most of the time the symptoms are minimal at first and progress gradually.	1. The onset is generally acute so that often even the exact minute is known. The symptoms are usually severe from the beginning.
2. The abdominal pains are in the foreground and are localized in the umbilical region or in the right lower quadrant.	2. (As in acute appendicitis.)
3. There is early and repeated vomiting.	3. (As in acute appendicitis.)
4. Herpes febrilis is not frequent.	4. Herpes febrilis is relatively common.
5. The fever does not often exceed 38.5 degrees.	5. The fever is high in the beginning, seldom under 39 degrees and generally over 40 degrees.
6. The pulse is not usually more than from 120 to 130, and in the beginning is not small.	6. The pulse is generally between 140 and 160; it is small and sometimes barely perceptible.
7. There is reflex abdominal spasm and in severe cases a boardlike abdomen is found.	7. Reflex spasm of the abdomen is not very marked; usually a "doughy" consistency may be noted.
8. Pain on the right side is common. The thighs are often flexed.	8. There is no typical position. The child generally throws himself about restlessly.
9. Pressure pains are strongest in the abdomen.	9. Tenderness of the entire abdomen is present but is not marked.
10. There is more or less aggravation of the pain on sitting up. In peritonitis due to perforation the child refuses to sit up and tries to lie still.	10. The child sits up without resistance and does not complain of pain.
11. There is pain on flexing the right thigh when the appendix is near the psoas.	11. There is little if any pain on flexion of the thighs.
12. Constipation is usual.	12. Diarrhea is frequent, often at the beginning.
13. Usually very little change in the facies occurs except in the advanced cases where the hippocratic facies may be noted. The child does not appear to be very sick.	13. The individual looks very ill. There is cyanosis of the lips and the eyes are greyish.
14. The sensorium is intact.	14. Very often there is slight mental confusion, and in the severe cases coma.
15. A discharge is seldom seen.	15. About 50 per cent of the cases have a vaginal discharge in which the Gram-positive diplococcus is found.
16. The leucocyte count is generally not over 20,000.	16. The leucocyte count ranges from 25,000 to 30,000 and is frequently found to be above this level.

Diagnostic puncture has been used in many cases but only within the first forty-eight hours before adhesions have formed. This is not an absolute method for arriving at a diagnosis, however. In 30 cases in which abdominal puncture was done no accidents occurred. The author does not perform puncture of the pouch of Douglas which was advocated by Loewe. He is also against early operation. He operates on localized abscesses later on. Many times these abscesses rupture spontaneously into the intestine or through the umbilicus. Cardiac stimulants, an abundance of fluids, continuous infusions, blood transfusions, and sedatives are utilized. Little improvement has been seen when pneumococcus serum has been used, but it is given nevertheless. The pediatrician and the pediatric surgeon should know the composite picture of the disease and keep it in mind. (Franz). John A. Gius, M.D.

GASTRO-INTESTINAL TRACT

Gamna, C., and Pino, F.: Gastro-Intestinal Malignant Lymphogranuloma (Il linfogranuloma maligno gastro-intestinale). *Arch. ital. d. mal. dell' appar. digerente*, 1939, 8: 312.

The authors discuss the first case of malignant granuloma of the intestine reported in Italy in 1919 by Gamna because it still represents the most characteristic manifestation of this disease. The various cases described during the past few years have established clearly its anatomicopathological aspects and approximately its clinical aspects. They distinguish the gastro-intestinal, retroperitoneal, and hepatosplenic forms. The macroscopic lesions of the gastro-intestinal wall are of ulcerative or neoplastic type and the latter, which also ulcerates, presents the infiltrating or the vegetative form. The lesions are often multiple and gastric lesions are frequently associated with intestinal ones. The principal localizations are, in their order of frequency, the stomach (the pyloric canal, the lesser curvature, the fundus, and the cardia), and the intestine (the first portion of the jejunum, the ileum, the duodenum, and the colon). Exceptionally, the esophagus and even more highly located parts are involved.

When the disease begins in the digestive tract, it does not tend toward early generalization, but nearly always invades the associated lymph nodes. Histological examination shows that the lesion usually starts in the mucosa and then infiltrates the other layers. There are cases in which there is only a primary lesion of the gastro-intestinal wall, and others in which this primary lesion is associated with invasion of the satellite lymph nodes; the disease remains localized. It seems that the primary intestinal and the retroperitoneal forms have a common pathogenesis. The observations of Sternberg's gastro-intestinal disease serve to show the etiological differences between tuberculosis and malignant granuloma.

The primary form of gastro-intestinal lymphogranuloma usually presents the clinical picture of an abdominal syndrome of indefinite type: meteorism, more or less pain, disturbances of canalization and of defecation, progressive debility and anemia, associated with fever and, less frequently, cutaneous

manifestations. These symptoms are usually introduced by general abdominal disturbances or by a prolonged febrile condition with vague and changing pains and painful sensations, or with real colics. After a variable time, the complex clinical picture acquires a more decisive aspect in that it indicates specifically a certain section of the digestive tract.

A differential diagnosis must be made between gastro-intestinal lymphogranuloma and malignant tumor, tuberculosis of the intestine, syphilis of the stomach, amebiasis, actinomycosis of the cecum and of the stomach, retroperitoneal lymphogranuloma, and abdominal periarteritis nodosa. Although the prognosis must generally be considered as unfavorable and the treatment useless, there have nevertheless been reports of surgical successes which show the necessity of accurate diagnosis and confirm the concept of the presence of a strictly limited first stage of the disease. RICHARD KEMEL, M.D.

Singleton, A. C.: Chronic Gastric Volvulus. *Radiology*, 1940, 34: 53.

Gastric volvulus is defined as an abnormal anterior or posterior rotation of part or almost all of the stomach about either the coronal or the sagittal axis of the body. The literature on the subject of this relatively rare condition is reviewed. There are apparently two types of gastric volvulus, the organoaxial, which is more common, in which the stomach is rotated about its long axis; and the mesenteroaxial, which is usually partial, in which the rotation is from right to left or left to right about the long axis of the gastrohepatic omentum. There is no typical age incidence, though adults are usually affected, and the sex incidence is equal.

The radiological findings in chronic gastric volvulus are characteristic: there is usually a high transverse bubble of gas under the dome of the diaphragm on both sides of the midline. The barium meal confirms the suspicion that volvulus of the stomach is present.

Two cases of persistent gastric volvulus, associated with hepatodiaphragmatic interposition, and one case of recurring gastric volvulus, alternating with anterior hepatodiaphragmatic interposition of the colon are reported.

The probable etiological factor in total volvulus is an abnormally long gastrohepatic or gastrocolic omentum, or both, probably of congenital origin.

HAROLD C. OCHSNER, M.D.

Sampson, D. A., and Sosman, M. C.: Prepyloric Ulcer and Carcinoma. *Am. J. Roentgenol.*, 1939, 42: 797.

The subject of the comparative frequency of benign ulcer and carcinoma in the pyloric region has caused considerable argument even though the literature is relatively small. There are two divergent schools of thought, one of which is represented by Hampton, who believes that benign ulceration in this region is of such infrequent occurrence that all prepyloric ulcers should be considered malignant until proved otherwise, not only by complete serial sectioning but also by protracted follow-up. His analysis of cases seen at the Massachusetts General Hospital showed that carcinoma outnumbers benign ulcer 12 to 1. On the other hand, Singleton stated that he found benign prepyloric ulcer to be twice as frequent as the malignant variety in his series of patients studied at the Toronto General Hospital.

Several difficulties are immediately encountered in studying this problem. The first is the accurate meaning of the term "prepyloric." Roentgenologists, surgeons, and pathologists loosely apply it to that portion of the stomach fairly close to the sphincter. Hampton has defined this region as being limited to exactly 1 in. proximal to and including the ring. Singleton used the same definition.

This study is based on a series of 545 cases admitted to the Peter Bent Brigham Hospital from 1913 to 1937 and includes all those cases of gastric ulcer and gastric carcinoma subjected to operation and autopsy during this twenty-five-year period. The lesions are classified as prepyloric by strict adherence to the Hampton definition. The material contains 46 carcinomas within the prepyloric inch and 11 ulcers. In addition there are included 5 carcinomas near the pylorus or just proximal to it and 19 ulcers.

The study also demonstrates that there is no subjective or objective means for differentiating benign from malignant lesions and that it may be necessary to cut many histological sections through the excised ulcer to find the area of carcinoma. For this reason the authors conclude that prepyloric ulcers which do not disappear entirely in a few weeks should be treated by radical resection and even though they do disappear they should be carefully followed up and examined periodically for many years.

SAMUEL J. FOGELSON, M.D.

Walton, Sir J.: Carcinoma of the Stomach. *Brit. M. J.*, 1939, 2: 1127.

Cancer of the stomach still remains one of the greatest of human tragedies. In England there is an annual death rate of approximately 15,000 due to cancer of the stomach. In the United States the number is approximately 38,000 per year. Carcinoma of the stomach and of the breast and uterus constitute the commonest forms of malignancy.

Only too frequently the onset of carcinoma of the stomach is slow and insidious and the patients are previously in perfect health. The progress of its treatment has not kept pace with that of other gastric lesions. However, the writer believes that some progress has been made in the radical treatment of cancer of the stomach and that surgery has restored many hopeless sufferers to more happy days. The author doubts whether the disease is on the increase and would attribute the increased incidence to more careful and complete investigation from a diagnostic standpoint.

Carcinoma of the stomach occurs most frequently in the age decade of from fifty to sixty years. It

may occur as early as from twenty to thirty years of age and even after eighty. The male sex is more frequently attacked than the female. The writer believes that the modern fashion of treating all peptic ulcers medically has led to many carcinomas being overlooked. It was formerly believed that the majority of cases were primary and that relatively few were dependent upon a previous ulcer. A small percentage are undoubtedly secondary to adenomas but these are relatively uncommon. In the writer's series of 572 cases of gastric cancer only 27 were accepted as having their origin in previous adenomas.

The question whether carcinoma may be secondary to previous gastric ulcer has led to an increase of discussion. Stewart's figures are generally accepted on this point. He finds that about 9.5 per cent of ulcers become carcinomatous, and this change is likely to occur in 1 of 4 of the prepyloric ulcers. About 17 per cent of the carcinomas have their origin in an ulcer. The author demands the following proof that the cancer developed on an ulcer basis: the patient must have had a previous definite ulcer history; the test meal must show the presence of free hydrochloric acid, often above normal; at operation the lesion must simulate a chronic ulcer; and the microscopical report should indicate that carcinoma developing from ulcer was the sequence of events. With these criteria 61 of the 572 patients were grouped as having a cancer arising in an ulcer, i.e., 10.5 per cent. It is probable that cases of inoperable type may include some in this category which are necessarily overlooked.

Sir Arthur Hurst believes that he has evidence to show that the cases which were previously regarded as primary are dependent upon a gastritis. He believes that the achlorhydria is caused by the gastritis and is not due to the growth, and he found that in every case of undoubted ulcer-cancer free hydrochloric was present; and when there was no evidence of such a previous ulcer the acid was usually absent even in very early stages of the disease. He reports 5 cases in his series in which the achlorhydria was present before the carcinoma developed. He does not believe the acid follows after the onset of the growth. Hurst concludes that carcinoma never develops in a healthy stomach; but if a patient with a constitution predisposing toward carcinoma also has achlorhydria and gastritis he will probably develop cancer. Furthermore, he believes that the early recognition and treatment of gastritis may do much to diminish the frequency of stomach cancer.

SYMPTOMS

The chief difficulty in the successful treatment of cancer of the stomach is that nearly two-thirds of the patients seek surgical help only after the disease has become inoperable. In many patients the symptoms may be of only two or three weeks' duration and the condition found inoperable when advice is first sought. It must be remembered that a gastric ulcer practically never starts after the age of forty. A patient forty years of age or beyond with a negative past history and complaining of dyspepsia should be regarded as a cancer possibility until the contrary is definitely proved.

Carcinoma of the stomach may be divided into three separate groups: namely, cancer of the cardiac orifice, cancer of the pyloric orifice, and cancer of the body of the stomach; the latter forms the largest group. It should be remembered that carcinoma of the cardiac or pyloric orifice generally leads to obstruction and these symptoms may entirely mask the underlying cause. When the growth is located in the cardiac orifice the patient develops symptoms of difficulty in swallowing. This history is steadily progressive and the obstruction is marked at first only for solid foods but later there is great difficulty in the swallowing of liquids. In a patient of forty years of age such symptoms usually mean carcinoma either of the esophagus itself or of the cardiac orifice of the stomach. Cancer in the body of the stomach may produce symptoms arising very suddenly and very deceivingly. The onset may occur with a large hematemesis and such patients have frequently been treated for many months or weeks for a supposed ulcer until the cancerous growth was hopelessly inoperable.

In the author's series of gastric carcinoma there were 112 cases which presented the history and symptoms of a previous gastric ulcer. The greatest reliance, from a diagnostic standpoint should be placed on a careful clinical history and followed up by careful clinical investigation. Accessory methods of clinical investigation include the presence of occult blood in the stools and in the test meal, especially if the blood persists. The presence of achlorhydria is suggestive but it may occur with a simple gastritis. Careful screening and x-ray examination is of great value but it should be undertaken by a skilled roentgenologist. Gastroscopy in the difficult cases may also be of great value.

TREATMENT

In considering the surgical treatment of gastric cancer one must remember that without surgery the patient is condemned to death. No other method of treatment offers any hope. The writer advises operation in every case in which there is no gross evidence of metastases, and even if metastases are present a radical resection may afford the patient one or more years of comfortable existence. Many large tumors may prove at operation to be removable. However, in the writer's series of 572 cases of gastric cancer such a removal was possible in only 224 cases, that is, about 39.1 per cent. It seems probable that the operability will be extended for this disease as surgeons gain more experience. Resection should be as wide as possible including all lymph glands draining the affected areas.

The writer's operative mortality averages about 30 per cent. There were 57 cases of simple anterior gastro-enterostomy done as a palliative means to relieve the obstruction, yet this simple operation was associated with a mortality of 42 per cent. When

simple exploratory laparotomy was carried out the mortality averaged approximately 18 per cent. Gastro-enterostomy should be recommended to those patients with a definite pyloric obstruction. Occasionally a gastrostomy seems justifiable for cases of cardiac obstruction.

SUMMARY

The author concludes that the results of surgical treatment of gastric cancer compared with similar treatment elsewhere in the body are very disappointing. This is perhaps due to the high percentage of inoperable cases. Nevertheless the author feels it is the surgeon's duty to carry out a resection wherever it is possible and the patient must always receive careful preliminary preparation. A blood transfusion before or during the operation is most beneficial and often a necessity.

One cannot ever say that a patient is permanently cured until that patient has died free of a return of the disease, and death has resulted from some other cause. It is usual not to regard any patient permanently cured. Five-year survivals are well worthwhile and may be spoken of as clinical cures. The writer reports a series of 150 patients who had the radical resection operation performed for gastric cancer; of this total, 111 survived the operation. Of these 111 patients only 27 have remained free from recurrence over a five-year period.

One must conclude that although the outlook is still bad despite the results of surgical intervention, yet the figures are improving somewhat and cancer of the stomach, which is otherwise a fatal disease, can in a certain number of patients be cured by surgical operation. JOHN W. NUZUM, M.D.

Graham, J. G., Alexander, J. C., and Kerr, J. D. O.: Hemorrhage in Peptic Ulcer: A Review of 241 Consecutive Cases. *Lancet*, 1939, 237: 727.

The treatment of hemorrhage from peptic ulcer by early and more liberal mouth feedings has been claimed to have many advantages over the older methods, which often amounted to semi-starvation. In order to evaluate the claims made for the newer methods, the authors reviewed all cases of peptic ulcer complicated by hemorrhage treated in a medical unit of the Western Infirmary of Glasgow during the ten-year period from 1929 to 1938. There were 434 patients with peptic ulcer, 241 of whom had had either hematemesis, melena, or both. Fifty-nine of these patients had gastric ulcers; 134, duodenal; and 7, gastrojejunal; in 41 the site of the ulcer was not determined.

The earlier medical routine was one in which the patient was completely starved for from two to four days, morphine was given liberally, and hemorrhagic shock was treated with saline solution and glucose, which was administered by rectum. When the bleeding stopped, 1 oz. drinks of albumin water were given hourly and then the diet was gradually increased with peptonized milk. On the eighth day the patient was given approximately 1,450 calories.

During the last three years, however, the preliminary starvation was shortened and often omitted; morphine and the rectal administration of saline solution were continued. Many of the patients received from the first day of admission a diet described by Hurst, which contained 2,900 calories and within three weeks totalled 3,500 calories. In addition, a third type of therapy was used for mild cases of melena, which had a caloric value of 2,500 calories daily.

There were 20 deaths in 165 cases treated with a low caloric intake, no deaths in 44 cases treated with a high caloric intake, and 3 deaths in 53 cases treated with a bland diet. There were 8 cases in the series in which, after two weeks of medical management, hemorrhage persisted. One patient died before surgery could be attempted and only 2 of the remaining 7 patients operated upon survived. For this reason the authors concluded that the part played by surgery in the early treatment of hemorrhage from peptic ulcer is very small.

There were, therefore, 23 deaths in this series of 241 patients, a mortality rate of 9.45 per cent. All deaths were included in obtaining this figure. Thus, 5 cases were included in which death was due to some postoperative complication. Had these patients been excluded and the fatality rate expressed in terms of patients actually bleeding to death in medical wards, the figure would have been 4.98 per cent. In an endeavor to assess the value of the more liberal diet used, the fatality rates in all types of cases before and after its inception were contrasted. A reduction of from 10.8 to 6.5 per cent followed its introduction, and this has led to the conclusion that more generous feeding is an important factor in recovery from hemorrhage in peptic ulcer.

SAMUEL J. FOGELSON, M.D

Chamberlin, G. W.: The Roentgen Anatomy of the Small Intestine. *J. Am. M. Ass.*, 1939, 113: 1537.

Anatomically the small intestine is a convoluted tube beginning just distal to the pylorus and ending at the ileocecal valve. Its normal roentgen morphology is dependent on interplay between three factors: muscular tone, physiological motion, and mucosal pattern. Proper study demands a standard type of meal so that the roentgenologist may establish the variations for his particular technique. Chamberlin uses 5 oz. of standard barium sulfate, and 5 oz. of distilled water. The latter rather than tap water is used to avoid chlorine disturbances in the intestinal pattern.

Normally the head of the barium meal reaches the cecum in from one and one-half to three hours and the small intestine is completely empty in from five to six hours. The caliber of the lumen and the rate of peristalsis diminish from above downward. The cap and superior duodenum are usually retentive of barium but in the distal portions the stream is intermittent while peristaltic rushes and to-and-fro motions are seen. In the jejunum and ileum the barium stream tends to be continuous

Fig. 1

Fig. 2

Fig. 3

Fig. 1. The normal mucosal pattern in the jejunum is herring-bone or reticular.

Fig. 2. Longitudinal folds in the jejunum occurring as a result of segmental contraction.

Fig. 3. Mucous membrane pattern in the ileum. This appearance has been called the "stacked-coin" pattern.

with occasional peristaltic rushes. Complete arrest of the meal may occur in the ileum but passage into the colon will follow if the patient is allowed to eat. Segmental contracture of the jejunum produces longitudinal mucosal folds, as shown by the "barring" pattern of Forssell.

The mucosal pattern varies with activity. In the duodenum it is coarsely reticular. In the jejunum it is finer like a herring-bone pattern, and may be obliterated by the passage of a bolus. A "snowflake" pattern is left as the meal progresses. Longitudinal folds may occur as the result of segmental contraction. In the ileum, the column of barium may show no definite profile pattern, or it may resemble a stack of coins. Failure of rotation, intra-abdominal hernia, congenital membranes, and veils attached to the duodenum, as well as congenital narrowing of the lumen can be recognized roentgenologically. Congenital diverticula and sometimes even Meckel's diverticula can also be visualized. Excellent roentgenograms of these conditions are presented. JOHN L. POOL, M.D.

Finochietto, R., and Marino, H.: The Treatment of Multiple Tumors of the Small Intestine (Tratamiento de las tumoraciones múltiples del intestino delgado). *Arch. argent. de enferm. d. apar. digest.*, 1939, 14: 634.

Obstruction of the small intestine, caused by multiple stenosis, is very interesting, both from a general and an etiological point of view. Tumors as a cause of multiple stenosis of the small intestine are, without doubt, very rare, and are found nearly always at operation or autopsy.

The authors, after a long search in the archives of certain hospitals in their own country and in the United States, present the following 8 cases, 5 of which were treated by them: (1) multiple granulomatosis of the small intestine; (2) duodenal obstruction with tuberculosis of the small intestine of tumoral form and with obstructive symptoms; (3) multiple metastatic cancer of the small intestine with obstruction; (4) and (5) 2 cases of tumoral tuberculosis of the small intestine; (6) multiple carcinoma of the small intestine with obstruction; (7) multiple carcinoma of the small intestine; and (8) multiple metastatic sarcoma of the small intestine. The characteristics common to all these cases were the long course of the disease and the intensification of the symptoms, often leading to operation.

The symptoms were those of a chronic stenosis: abdominal pain, colic, meteorism, diarrhea, vomiting, a sensation of gastric fullness, occasional palpable tumors, constipation, nausea, and Koenig's syndrome. Physical examination always gave poor results: in a few cases the findings were positive, and roentgenological examination indicated chronic obstruction of the small intestine. The lack of definite symptoms is due to the fact that the symptoms are always caused by the proximal stenosis. The stenosis, which is almost always of more importance than the other symptoms, conceals and hinders the examination of the distal tumors. As a result, the internist or surgeon frequently overlooks the distal lesions and neglects their treatment during operation. The findings seem to be the result of mechanical and inflammatory factors: the intestinal contents, flowing against the first obstruction, cause lesions of the mucous membrane, which are followed by an inflammatory reaction, narrowing of the intestinal tract, and finally obstruction.

As the diagnosis of multiple tumors of the small intestine is very difficult and sometimes impossible, the authors believe that when the abdomen is opened to relieve an obstruction of the small intestine the surgeon should be prepared to perform a

thorough exploration of it. If the operator finds a tumor or even a minimal narrowing of the lumen, he must at once visually examine the whole intestine. This systematic exploration must be very painstaking to be effective and innocuous. The authors suggest the following technique:

An abdominal incision (any one of those generally used) is made. When the first lesion has been found it is marked with an intestinal forceps and the flexura ileocecalis or the duodenojejunalis is investigated. Starting at either flexure, the surgeon exteriorizes the intestine and runs it through the fingers. He notes the number of centimeters that pass and, when a lesion appears, he definitely ascertains the distance between the tumor and the flexure. When a tumor is once found, it must be marked with the forceps and examination of the intestine should be resumed until the other flexure is reached. It must be remembered that frequently one is confronted with distended loops, which tend to bulge out of the abdomen.

By this method of examination no lesion can escape examination, and as only a small portion of the intestine is exposed at a given moment, the organ suffers very little. The localization is perfect, each lesion can be examined, and the treatment can be decided upon with the best possible knowledge of the condition.

In the case of intestinal tuberculosis in particular, the proximal obstruction is almost always the greatest one, and the more important stasis and distention of the afferent loop are above it. The rest of the intestine, empty and flaccid, may have important strictures which are easily overlooked. On the other hand, a distal stricture may conceal other lesions in a distended proximal loop. In 1 of the cases (intestinal tuberculosis of tumoral form) the most important tumor was the lowest one and was seen only after the finding of three others. One must also remember that intestinal spasms may give a false impression of extension in a limited lesion (Reichel). As a matter of fact, these spasms are one of the most common causes of failure in the most perfect end-to-end anastomosis.

Once multiple intestinal obstruction has been found, the surgeon may follow one of two possible procedures: (1) resection of the affected intestine, or (2) a short-circuiting operation which, leaving the tumor, re-establishes the continuity of the intestinal lumen. The first procedure is indicated in cases of suspected malignancy; it is very simple from a surgical standpoint. Undoubtedly it is the most satisfactory procedure, but also the most dangerous for the patient. The coaptation of both ends may not be easy; a good method of overcoming the difficulty is to section the narrower loop very obliquely so as to adapt its lumen to that of the more distended portion, or a laterolateral anastomosis may be substituted, which is recommended in case the technique is not perfect. If a resection is performed, it is better not to resect more than two yards of intestine, in order to avoid disagreeable consequences. The second procedure, the short-circuiting operation, requires two conditions: (1) certainty that the tumor is benign, and (2) assurance that the multiplicity of the tumors will not provoke digestive troubles. The authors' second, third, and eighth cases were treated in this way with satisfactory results.

When a lesion has not reached the tumoral form, but its characteristics and the evolution of the other lesions indicate the possibility of such an eventuality, it must receive the same treatment as the tumoral form. This fact must be kept well in mind when the type of operative procedure is determined. One of the authors' cases of tumoral tuberculosis had some simple hypertrophic infiltrations, which were treated like the more advanced tumoral forms. The suture of the abdominal wall must be done very carefully, and a good strapping will avoid the tendency toward evisceration, which is very common in these cases.

The Wangensteen method of pre-operative and postoperative treatment of cases with serious obstruction was used with very satisfying results.

When an intestinal lesion of a definite nature is found, exploration is of great value, because, in addition to the first process, another of a different nature and which requires more active treatment can frequently be found. This is true when, during the operation for intestinal syphilis, we also find cancer, which frequently coexists with the former disease. HECTOR MARINO, M.D.

Bergendal, A.: A Contribution to the Knowledge of Primary Duodenal Cancer. *Acta radiol.*, 1939, 20: 417.

Primary carcinoma of the duodenum has been divided into 3 categories by Mateer and Hartman. This classification is based on the anatomical site of the lesion: (1) supra-ampullar, arising from the mucosa between the pylorus and the papilla of Vater; (2) peri-ampullar; and (3) infra-ampullar, arising between the ampulla of Vater and the duodenojejunal junction. The peri-ampullary type occurs in two-thirds of the cases, while the infra-ampullary type is the least common. The tumors may grow outward into the lumen as cauliflower growths, or may constrict the duodenal lumen by scirrhous annular infiltration of the wall. In any case, diagnosis is difficult because of the similarity of the symptoms to those of other upper abdominal diseases. Nausea, vomiting, marked weight loss and epigastric pain are frequent features. Supra-ampullary carcinoma producing deformity of the cap cannot readily be distinguished from duodenal ulcer except by repeated radiological examination.

Ampullary carcinoma will early produce stenosis of the bile and pancreatic ducts. Differentiation from carcinoma of the head of the pancreas can be made only when the latter condition has expanded the duodenal curve without producing mucosal erosion. Chronic pancreatitis may produce a similar x-ray picture. Infra-ampullary tumors produce duo-

denal stasis and may be confused radiologically with arteriomesenteric or extraluminal tumor pressure as from retroperitoneal lymph nodes. A case of obstruction just proximal to the duodenojejunal junction is cited in which diagnosis was not made for ten months despite repeated x-ray studies. Resection of the scirrhous carcinoma and end-to-end anastomosis of the duodenum was, however, still possible, and the patient was symptom free eighteen months later. The author recommends more careful examination of the infra-ampullary duodenum during x-ray studies of the gastro-intestinal tract, especially by means of multiple positions, manual compression, and a thick barium mixture. JOHN L. POOL, M.D.

Cashion, W. R.: Pericolic Membranes. *Radiology*, 1940, 34: 66.

The author lists four types of membranes found in the right lower quadrant: postoperative adhesions, Jackson's membranes, Lane's bands, and pericolic membranes. The latter are congenital and consist of a re-duplication of the parietal peritoneum extending up on the side and frequently around the lower end of the cecum, with a tendency to shorten the meso-appendix and produce strangulation.

The symptomatology of pericolic membrane is said to be variable; the enteroptotic individual is most likely to be affected. There may be right iliac pain and tenderness, nausea and vomiting, epigastric pain, flatulency, and "digestive disturbances."

The roentgenological diagnosis is said to be based upon the presence of pyloroduodenal spasm, relieved by antispasmodics, moderate six-hour gastric retention, ileocecal delay with acute angulation of the terminal ileum at its entrance into the cecum, smooth deformity of the cecum and outer border of the cecum and outer border of the ascending colon, and spasm of the transverse and descending colon, as visualized in the six and twenty-four hour films. The cecum is cone shaped. Sharp angulation and reduplication of the hepatic flexure may be caused by upward extension of the membranes to this region. HAROLD C. OCHSNER, M.D.

Patterson, H., and Webb, A., Jr.: The Mikulicz Procedure. *Ann. Surg.*, 1940, 111: 64.

A brief résumé of the Mikulicz procedure and its history is given, and mention is made of the contributions and techniques of other men in the management of carcinoma of the colon.

Four factors influence the choice of the operative procedure in a given case of carcinoma of the colon: (1) the condition of the patient, (2) the experience of the surgeon, (3) the site of the growth, and (4) the type and degree of complications. It is generally agreed that acute obstruction calls for preliminary cecostomy or colostomy, no matter what type of resection is to follow. Nearly half of the cases in the authors' series showed some obstruction; in 27 per cent a preliminary cecostomy was performed.

Critics of the Mikulicz operation cite the long morbidity, the necessity for multiple operations, the nuisance of the fecal fistula for a number of weeks, the likelihood of hernia, and the possible "inadequate" removal of the lymphatic-bearing area adjacent to the growth. The authors acknowledge the necessity for multiple operations and prolonged hospitalization in this procedure; they believe, however, that the advocates for primary resection and anastomosis are misleading in their assertions.

A review of the routine employed in the multiple-stage resections for this series is given.

Mention is made of W. J. Mayo's report on 262 resections of the large intestine for carcinoma. There were five-year cures in 54 per cent of the patients who survived operation. Most of the operations were of the Mikulicz type. A summary of the reports of Hockenegg, Anschuetz, Petermann, Moszkowicz and Mikulicz shows that of 79 operative survivors, 20 are known to be dead of recurrence; 36 are known to be living and well.

The report from the Roosevelt Hospital, New York, includes 63 cases in which a carcinoma of the large bowel was resected by the Mikulicz method. There were 12 deaths, an operative mortality of 19 per cent. Of the 51 operative survivors, 9 are known to have died of recurrence. A critical review indicates that 20, or 54 per cent, of these patients were apparently cured by the Mikulicz type of resection.

The authors conclude that the Mikulicz procedure is still the safest method of removing a portion of the large bowel and that despite the disadvantages inherent in the procedure it is the procedure of choice in the average resectable colonic cancer. In their opinion, the procedure affords the patient a maximum chance for permanent cure when the correct technique is employed, and they believe radicalism is justified by the results obtained. Painstaking resection of the neighboring lymphatic-bearing area of the mesentery is considered essential. Late recurrences of carcinoma of the colon are rare, and a three-year survival period is more indicative of permanent cure than a five-year period in many other types of cancer. EARL GARSIDE, M.D.

Ravdin, I. S., Rhoads, J. E., and Lockwood, J. S.: The Use of Sulfanilamide in the Treatment of Peritonitis Associated with Appendicitis. *Ann. Surg.*, 1940, 111: 53.

The authors are convinced by the clinical evidence presented that sulfanilamide therapy subsequent to operation for appendicitis has ameliorated the severity of the reaction in spreading peritonitis in many cases and has saved some lives which otherwise would have been lost.

Surgical technique, anesthesia, pre-operative and postoperative treatment were the same for all the cases in this series. The number of patients in the group treated prior to the use of sulfanilamide (up to 1936) was 552. Drainage was employed in 37 per cent of these. Eight deaths resulted, which made the gross mortality 1.4 per cent. One death occurred in a patient upon whom operation was not done. From

1936 to May, 1939, 257 patients received sulfanilamide, and drainage was instituted in 43 per cent. One death resulted, a mortality of 0.4 per cent. The patient who died did not receive sulfanilamide until three days after operation. This death occurred very early in the series, and since that time 250 consecutive operations on patients with acute appendicitis have been done without a death from any cause.

Operation was performed immediately upon admission of the patient to the hospital whenever feasible; it was delayed in less than 2 per cent of the cases. For patients more than fifteen years of age, spinal anesthesia was employed, if possible; for those under fifteen years of age, open drop ether was usually employed. A McBurney incision was used. The appendix was removed regardless of its pathological condition, except in cases in which the wall of a definite abscess would have been destroyed by its removal. When an abscess was found against the lateral wall it was drained extraperitoneally if possible. Occasionally, when marked induration was found in the cecal wall, a rubber catheter was introduced through the stump of the appendix. Drainage was instituted whenever indicated.

Postoperatively, nothing was given by mouth or rectum. Suction drainage was used as a prophylactic measure. Morphine sulfate was administered routinely. Fluids were given intravenously and in all severe cases sulfanilamide was administered by hypodermoclysis. Substantial quantities of physiological saline solution were needed for this and had to be reckoned in the total intake. Fluid given by vein contained 5 per cent glucose, and usually half of it also contained 9.0 gm. of sodium chloride per liter. Serum-chloride and serum-protein concentrations were determined every forty-eight to seventy-two hours. Transfusions of citrated blood were often given when indicated.

Sulfanilamide is now being used by the authors in all cases in which drainage has been carried out, and occasionally in borderline cases. It is also being employed pre-operatively as an adjunct to the delayed method of treatment.

Sulfanilamide is given in 0.8 per cent concentration in physiological saline solution by hypodermoclysis. The dosage is usually 8 gm. the first day and is reduced about 1 gm. a day, the amount being varied to some extent according to the response. In less severe cases the usual dose is 6 gm. the first day, which is given by mouth. A gradual reduction to 3 gm. is made over a period of from four to seven days, and then the treatment is stopped. Each day's dose is given in 4 installments at six-hour intervals. The blood concentration of sulfanilamide should be maintained above 5 mgm. per cent, and the authors have kept it above 15 mgm. per cent in certain cases. Blood counts from every twenty-four to forty-eight hours are advisable. The decision to start fluids by mouth rests upon the occurrence of audible peristalsis or the passage of flatus, a fall in temperature lasting twenty-four hours, abdominal relaxation on the left side, and a fall in the pulse rate. Sulfanilamide is seldom stopped before the fifth day, and frequently not before the seventh day. The reactions to this treatment are very similar to those seen after oral administration of sulfanilamide.

In the very early cases in which sulfanilamide was used, it was discontinued after from forty-eight to seventy-two hours when the culture failed to show hemolytic streptococci. However, the demonstrated effectiveness of sulfanilamide against the escherichia coli caused the authors to continue the drug when that organism was present. Now the drug is used regardless of the culture report.

The method of administration was based upon the observation that the blood level was more constantly maintained when the drug was repeatedly administered at relatively short intervals.

The authors conclude that the improvement shown in their series is the result of the employment of sulfanilamide, since no other known factor was changed. A number of their patients with very extensive peritoneal infection secondary to appendicitis have recovered with much less reaction than would have been predicted on the basis of experience with the first series of cases.

Sulfanilamide readily diffuses into the peritoneal fluid of the experimental animal. All available evidence indicates that the peritoneum is a favorable site for the action of sulfanilamide.

In view of the fact that appendiceal peritonitis is non-specific, the decrease in mortality and the improvement in the course of the disease obtained with sulfanilamide is in agreement with the concept of one of the authors (Lockwood), that the character of the lesion is more important with regard to the effectiveness of the drug than the specificity of the organism.

EARL GARSIDE, M.D.

Kross, I.: The Appendiceal Stump: Its Manner of Healing in the Open and in the Closed Method of Treatment. *Arch. Surg.*, 1939, 39: 1016.

The author summarizes the arguments for and against inversion of the appendical stump. Although the clinical and pathological evidence favors the method of non-inversion, the buried method is still used most extensively. To determine the method of choice Kross performed appendectomies on rabbits. In 23 of them he buried the stump; in 16 he employed simple ligation of the stump without carbolization. At intervals up to ninety days, the abdomen was re-opened, and the appendical stump was examined *in situ* and then removed for microscopic examination.

One of the most striking features noted in the study of the sections from the buried stump was the combination of hemorrhagic infiltration and ulceration of the mucous membrane of the cecal wall distal to the insertion of the purse-string suture. In spite of the fact that during the insertion of the purse-string suture no visible injury to the blood vessels and no visible hematoma was noted, the microscopic picture of hemorrhagic infiltration was a constant phenomenon. In contrast to this picture, examina-

tion of the unburied stump treated by simple ligation showed an absence of these features in every specimen examined. Another interesting feature noted macroscopically was the frequent marked enlargement of the mesenteric lymph nodes in the experiments in which the stump was buried, and the absence of this change when the stump was left unburied. Adhesions were present in all of the experiments but were much more extensive in the experiments in which the stump was buried. Distal to the ligature the stump proper showed massive necrosis in all instances. In the cases in which simple ligation was done there was an abrupt change at the site of ligature, the tissue distal to the ligature showing massive necrosis, the tissue proximal remaining normal. In the cases in which the stump was buried, however, there was hemorrhagic infiltration and necrosis with ulceration of the mucous membrane in part of the cecal wall between the purse-string suture and the appendical ligature. In several of the inverted stumps, pinhead-sized cecal abscesses were noted. No abscesses were found in the unburied stumps. These findings point clearly and definitely to the ordinary ligature (without inversion) method as the simplest, safest, and most effective procedure in the treatment of the appendical stump.

AUGUST JONAS, JR., M.D.

Gabriel, W. B.: The Treatment of Hemorrhoids. *Brit. M. J.*, 1939, 2: 1266.

The choice of treatment for hemorrhoids depends on careful examination and an accurate estimation of the condition presented in each particular case.

Inspection, digital examination, and proctoscopy are required in all cases. External piles must be differentiated from internal piles which are prolapsed and have become overgrown with squamous epithelium. The groove which originally marked the mucocutaneous junction, due to the attachment of the longitudinal muscle, usually persists and separates an internal pile quite clearly from the external variety.

The treatment of external piles depends on the presence or absence of thrombosis (anal hematoma). A solitary tense anal hematoma can be satisfactorily excised under local anesthesia. The large conglomerate type of anal hematoma is best treated on expectant lines. Skin tags at the anal margin may subside with lead lotion compresses, but if large should be excised under local anesthesia. When associated with prolapsing internal piles (intero-external type) a formal hemorrhoidectomy is the best treatment.

In the treatment of internal hemorrhoids, an important factor is the presence of associated anorectal conditions, which must be accurately diagnosed. These include fissure-in-ano, fistula, and not infrequently carcinoma of the rectum; hence a high digital examination and sigmoidoscopy with this in mind should be done in all cases. The choice of treatment is also influenced by the finding of a pelvic tumor in women, or prostatic enlargement in men. The presence of cirrhosis, or chronic cardiac or pulmonary disease also influences treatment, and therefore the general state of patients must always be carefully observed.

Palliative treatment. When small internal piles are associated with generalized congestion of the lower rectum, as may occur in stout subjects with hepatic congestion or constipation, medical treatment is directed toward limiting the intake of meat and alcohol. Free drinking of water is encouraged to enable aperients to be drastically cut down.

Prolapse and thrombosis, especially when accompanied by local sepsis, with ulceration and sloughing, necessitates bed rest. The prolapsed piles should be reduced gently, and a firm pad moistened in lead lotion should be kept in place by a T-bandage. When the piles cannot be reduced, the surrounding area should be shaved and a mild antiseptic solution applied every three or four hours. In many cases nothing further need be done after a week of bed rest. Other cases may require a hemorrhoidectomy.

Injection treatment. The ideal cases for injection are first-degree piles. A single small vascular pile can almost invariably be cured by a single injection. Contraindications to the injection treatment are: most third-degree piles; anal fissure; a fibrous polyp; proctitis; or any inflammatory condition such as abscess or fistula.

In subjects under thirty years of age, it is impossible to guarantee a permanent cure by any method, including operation, and for this reason injection is the method of choice in these individuals.

The solution used at St. Mark's Hospital, London, is 5 per cent phenol in almond oil, with 2 gr. of menthol to 1 oz. Albright's solution. For first-degree piles there is a high percentage of cures; in second-degree piles, recurrence is common within from three to five years; and in the third-degree type there is at best some amelioration in prolapse for perhaps from three to twelve months, but any sort of permanent cure is not likely to be achieved.

Operative treatment. This is the method of choice for the permanent cure of internal piles of the third degree, particularly the intero-external variety. Operation is also indicated when piles are complicated by a fibrous polyp, fissure, fistula, or any other rectal lesion which also requires surgical care.

The author favors the use of local anesthesia with 1 per cent procaine injected by Hirschman's technique. The Whitehead operation, the clamp and cautery method, excision and suture over a clamp, and many other methods should all be relegated to the past. A modification of the original Salmon operation is preferable, which enables the three primary piles to be removed completely; the ligatures are tied around the pedicles of the piles and are fixed by the inclusion of the longitudinal muscle, so that they cannot slip upward and expose raw surfaces in the anal canal. The author uses No. 3 chromic catgut, tied by transfixion, with the knot on the lumen.

The risk of postoperative stricture is almost absent, and secondary hemorrhage does not occur.

With careful postoperative care the anal wound is completely healed in two weeks. Pain is noticeably absent postoperatively. HAROLD LAUFMAN, M.D.

Rogers, H.: The Treatment of Pilonidal Sinus in Hospital Practice. *New England J. Med.*, 1940, 222: 79.

In 1935 the author and Hall, after a pathological study of a number of pilonidal-sinus specimens, made the following observations:

1. More than 70 per cent of the sinus tracts were midline structures small enough to be included in a piece of tissue measuring 2 by 2 by 5 cm.

2. The dye, which was injected to identify the tract and thought to be filling its finer branches, was found on microscopic study to be filling the lymphatic vessels in the normal tissue.

3. Infection was present in every instance and was the major factor responsible for any changes that had occurred in the original congenital defect.

4. Since epithelial tissue could not be identified in a number of specimens from recurrent cases it is probable that the recurrence was due not to incomplete removal of the tract, but to subsequent infection of the residual dead space.

On the basis of these observations the incidence of recurrence at the Massachusetts General Hospital has been lowered from 30 per cent in 1932 to 3 per cent by the adoption of the following plan of treatment.

The sinus tract is conservatively excised in the Outpatient Department. A midline skin incision is made under local infiltration anesthesia. If the lesion is complicated by extensive scarring the patient is hospitalized and a general anesthetic is used. Cautery-blade excision facilitates conservative removal of the tract by providing an almost bloodless field, but sharp dissection may be substituted by those who shun the use of cautery. As all of these wounds are infected they are packed with gauze to permit healing by second intention. However, if the defect is small and not too badly infected, primary closure may be successful. The patient is allowed to go home and returns twice weekly for dressings. All dressings should be done by the same surgeon who operates on the patient.

The average time required for healing by this method is approximately nine weeks.

EDWARD W. GIBBS, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Lamb, C. A.: Rupture of the Liver. *New England J. Med.*, 1939, 221: 855.

The diagnosis and treatment of rupture of the liver are presented with a report of 60 cases occurring in the Boston City Hospital from 1913 to 1937, inclusive. Rupture of the liver, although most commonly associated with violent injury, may result from a trivial accident, such as falling on the edge of a curb. The most frequent cause is a sudden blow to the trunk, regardless of the source of the blow. The necessity of early diagnosis is most important because the mortality increases from 2 to 5 per cent with each hour's delay.

The author discusses the anatomy of the liver, especially in reference to its supporting structures. Spontaneous hemostasis is rare in the ruptured liver because the blood vessels are valveless and thin walled, and fail to retract or contract after sectioning, and blood mixed with bile coagulates slowly.

The right lobe of the liver was damaged in 95 per cent of the cases; the left lobe, in only 3 cases. The dome of the liver was involved in 41 per cent and the inferior surface of the right lobe in 25 per cent. The anterior surface of the right lobe was ruptured in 6.5 per cent and the lateral surface in 12.5 per cent. There was a decreased incidence in other parts of the liver.

The greatest number of cases, according to age, occurred in young individuals. This might be explained on the basis of violence or that the bony protection is more supple and offers less resistance, even to minor blows. The laceration in this group was stellate in type, compared with the more or less straight tear in elderly patients. It was emphasized that in the young the rupture was more often on the inferior surface near the hilum, or at the site of attachment of the obliterated umbilical vein. In older patients the dome was more frequently ruptured. The ratio of males to females was 5 to 1. The majority of the lesions were sustained in automobile accidents.

Seventy-five per cent of the patients were admitted to the hospital immediately after injury, the longest delay being sixty hours. Eighty per cent were in shock on arrival, and the physical findings were pain throughout the abdomen with the greatest tenderness in the right upper quadrant. Laboratory findings invariably showed an elevated white count, between 13,000 and 28,000. Repeated blood counts are most essential in the diagnosis as a progressive fall in the red blood cells and constant rise in leucocytes indicate loss of blood into a serous cavity. The maximum leucocyte response was reached from five to six hours after the injury. The diagnosis depends upon the fact that there has been a blow to the midtrunk, signs of shock, tenderness in the right upper quadrant, rebound tenderness, and an elevated white count. Exploration is indicated in the presence of these findings.

Shock must be treated immediately. The blood pressure should be maintained between 90 and 100 mm. of mercury, systolic. This may necessitate a transfusion before, during, and after the operation.

General gauze packing is the quickest and most simple way to control hemorrhage. Larger blood vessels may be ligated and muscle may be used as hemostatic material. All fragments of liver deprived of blood supply are removed to avoid autolytic peritonitis. Drains to the site of injury are withdrawn on the third or fourth day, unless there is evidence of marked infection, when they are left

in for another five or six days. Bile drainage is expected in 50 per cent of the cases.

If the liver is ruptured it must be considered that a blow of sufficient force to cause this might have injured other structures. There is at times an accompanying rupture of the spleen or bladder.

Twenty-six of the 60 patients died before operation could be performed. There was a mortality rate of 44 per cent in the 34 patients operated on and the mortality rate for the entire group was 68 per cent. ROBERT ZOLLINGER, M.D.

Brulé, M., and Cottet, J.: A Clinical and Pathogenic Study of Dissociated Types of Icterus (Étude clinique et pathogénique des ictères dissociés). *Presse méd.*, Par., 1939, 47: 1609.

Brulé and Cottet define as dissociated icterus that type in which, in spite of intense jaundice, there is little or no retention of the bile salts but marked retention of the bilirubin. In cases of icterus due to obstruction of the bile ducts, this type of dissociation is rare. The bile salts may disappear gradually from the blood only in the terminal stages of obstruction of the bile ducts by cancer, when the patient is cachectic and taking no food, while the bilirubin remains at a high level. In catarrhal icterus, the dissociation between the retention of bile salts and bile pigments is observed chiefly in the later stages; the prolongation of this phase indicates a considerable degree of hepatitis. In infectious jaundice, dissociation between the bilirubin and bile-salt retention is frequent. In cirrhosis of the liver and yellow atrophy of the liver, the dissociated type of icterus is characteristic.

The fact that the dissociation between bile-salt and bile-pigment retention in the blood is not characteristic of obstructive jaundice, which is a surgical condition, but is characteristic of other types of jaundice that are not surgical conditions, is of definite aid in the differential diagnosis. This dissociation is explained as due to the fact that the bile pigments are of extrahepatic origin and are only excreted by the liver, while the bile salts are of hepatic origin and are also secreted by the liver. Hence, if the secretory function of the liver is damaged, these salts do not appear in the blood.

ALICE M. MEYERS.

Illingworth, C. F. W.: Recent Developments in the Surgery of Obstructive Jaundice, with Special Reference to the Risk of Hemorrhage. *Edinburgh M. J.*, 1939, 46: 762.

In a study of 50 patients with obstructive jaundice there were 12 who developed hemorrhage and in 8 it was a contributory cause of death. Many of these, however, had entered the hospital during the late stages of malignancy. An analysis showed that in 6 the bleeding was from the wound, in 5 from the intestine, in 3 from the stomach, and in the remainder from a variety of other locations. The jaundice resulted from carcinoma of the pancreas in 6, from metastatic carcinoma in 2, and from common-duct stones in 2. In 9 instances the jaundice was due to malignancy. It was likewise observed that there was hemorrhage in only 1 of 11 patients with an icteric index below 50. The risk of hemorrhage seemed to progress with increased jaundice. There were only 3 cases of hemorrhage among 22 cases in which the jaundice was of less than one month's duration, compared with 4 cases of every 5 in which the jaundice was of more than four months' duration.

Following this clinical analysis, there is a discussion of the theories that attempt to explain the bleeding tendency. The author believes that Vitamin K is used in the formation of prothrombin but that its action is not clear. There is a possibility that the liver, among its other functions, might be concerned with the synthesis and storage of prothrombin, and that in jaundice the prothrombin deficiency may be due to disturbance of this mechanism as well as to faulty intake of Vitamin K from the intestine.

ROBERT ZOLLINGER, M.D.

Carter, R. F., Greene, C. H., Twiss, J. R., and Hotz, R.: The Etiology of Gall Stones: A Critical Survey of the Literature, and a Study of the Applicability of Various Theories in 239 Operative Cases. *Arch. Surg.*, 1939, 39: 691.

The authors give a critical survey of the literature on the cause of gall stones. Two hundred and thirty-nine patients operated on for disease of the gall bladder were studied before, during, and after operation in an effort to correlate the findings with the various theories regarding the origin of gall stones. The study comprised a period of pre-operative observation of from one to thirty-six months. During this time there was an analysis of the material obtained by duodenal drainage and a chemical examination of the blood. At operation bile was collected for chemical, microscopic, and bacteriological examination.

From these detailed studies the authors concluded that no single factor or combination of factors could satisfactorily explain the stones found. There was no relationship between the composition of the hepatic bile or that obtained by duodenal drainage, and the chemical composition of the blood. Neither was there a connection between the cholesterol content of the blood and that of the gall bladder. It was found that the bile-salt cholesterol ratio varied widely in all pathological changes in the gall bladder, and that hypercholesteremia, determined by preoperative study, was not related to the presence of calculi. They found pancreatic ferments just as common in non-calculous gall bladders as in those with calculi. In 25 per cent of the cases with cholelithiasis, stasis was the only factor that was definitely demonstrated. However, 86 per cent of the gall bladders without calculi showed evidence of stasis, so that additional unknown factors must play a part. There were 24 cases of cholelithiasis unassociated with pathological or bacteriological evidence of infection or inflammation. It was concluded that infec-

tion is not necessary to the formation of gall stones and that perhaps the stones precede infection in many cases. ROBERT ZOLLINGER, M.D.

Carter, R. F., Greene, C. H., Twiss, J. R., and Hotz, R.: The Etiology of Stone in the Common Bile Duct. *Arch. Surg.*, 1940, 40: 103.

The secondary formation of calculi in the common bile duct led to certain clinicopathological studies of those factors which may cause the formation of such stones, in the hope that their occurrence might be prevented.

The authors' report is based on a study of 47 cases in which exploration of the common duct was performed at the New York Post-Graduate Medical School and Hospital. Of the 47 cases studied, 21 presented common-duct stones while 26 presented none. The study consisted of routine pre-operative cholecystographic examination, duodenal drainage, chemical study of the blood, chemical and bacteriological examination of the bile and stones from the gall bladder and the common duct, postoperative cholangiography, and daily chemical studies of bile from the drainage tube.

In general, the group of patients having common-duct stones, when compared with the group having no stones, were found to (1) be of a more advanced age, (2) have symptoms for a longer period, (3) have colics and jaundice more frequently, (4) show clumped calcium bilirubinate and calcium crystals in duodenal drainage more frequently, (5) show colon bacilli or streptococci in duodenal drainage, and (6) have achylia or hypochlorhydria more commonly. The above findings indicate that prolonged stasis predisposes to stone formation and infection.

The findings at operation were tabulated and discussed. In 16 cases no cause for dilatation of the common duct could be ascertained, and it was assumed that spasm of the sphincter of Oddi was responsible. In 9 cases pancreatitis was thought to be the probable obstructing factor. In 16 of the patients with common-duct stones, the stones were found to differ chemically and structurally from their associates in the gall bladder, and were therefore thought to have been formed in the common duct. Ninety per cent of the calculous ducts gave positive cultures of colon bacilli or streptococci, or both, while only 33 per cent of the non-calculous ducts showed these organisms. Chemical analysis of bile obtained from T-tube drainage in cases of long-standing obstruction showed low concentration of bile salts and cholesterol, even when there was no evident liver damage. In many patients with long-standing cholecystic disease and non-functioning gall bladders, there was increased concentration of bile in the common duct, the common duct apparently having to some degree taken over the concentrating ability of the gall bladder. In 5 of 8 cases studied by means of postoperative cholangiograms there was a functional spasm of the sphincter of Oddi, which was relieved promptly by the inhalation of amyl nitrite.

The authors are of the opinion that concentration of bile in the common duct with infection favors the deposition of bile sand and the formation of calcium-bilirubinate stones. As such, common-duct stone represents a separate pathological entity. The failure of cholecystectomy to break the chain of events responsible for the development of these stones probably explains recurrent, as contrasted to overlooked, stones in the common duct.

LUTHER H. WOLFF, M.D.

Walton, Sir J.: Surgery of the Common Bile Duct. *Lancet*, 1939, 237: 1253.

The author presents schematic drawings to illustrate the anatomical variations of the cystic artery, extrahepatic bile ducts, and the gall bladder. Injury or division of the right hepatic artery, the common duct, or hepatic ducts can be avoided if these structures are accurately identified. The author has had experience with 20 cases of division of the common bile duct, 6 of traumatic strictures, and 5 of inflammatory strictures. Methods of repairing accidentally divided ducts are discussed. If the injury is recognized at operation, an end-to-end suture is advisable. The Mayo technique of anastomosing the cut end of the duct directly to the duodenum may be used. An original method of reconstructing the common duct by utilizing a flap of duodenum and providing a valvular opening is demonstrated.

Signs and symptoms of congenital diverticulum of the common duct are emphasized, the most common of which is severe colicky pain often associated with jaundice. Occasionally, a diverticulum ruptures and gives symptoms similar to a perforated peptic ulcer. This lesion will not be overlooked if the region of the common duct is explored thoroughly in every patient.

The classical symptoms from impaction of a gall stone in the common duct are outlined. Although a patient with jaundice and a common-duct stone may be watched for a few days, in general, operation should be done early to avoid damage to the liver from continuous back pressure. Hemorrhage does not accompany jaundice in this type of case.

The differential diagnosis of obstructive jaundice from other types can usually be made from the clinical history and physical examination. If not, operation should be undertaken when the jaundice does not decrease within six weeks.

A common-duct stone may be present without jaundice, and a negative palpation of the duct at operation does not necessarily rule out common-duct stone. Operation on the gall bladder should not be complete until the common duct has been explored and the patency of its lumen determined. However, in the absence of jaundice and in the presence of a small cystic duct and a normal-sized common duct which is negative to palpation, simple cholecystectomy is sufficient.

Recurrent stones may form in the common duct in association with cholangitis but more often they

have been overlooked at the first operation. These usually consist of soft pigment and calcium, and contain no cholesterin. Nine such pure pigment stones were found in 55 cases of recurrent common-duct calculi.

The technique of exploring the common duct is presented. Through a right paramedian incision the cystic duct is divided until the common duct can be thoroughly explored. One opening only is made in the common duct and when it is closed it does not leave a remnant of cystic duct to form a new pouch like a gall bladder. Separate division of the common duct may be necessary if the cystic duct is very long and opens into the ampulla. After the common duct is incised forceps are passed through the papilla and spread as widely as possible to dilate the opening. External drainage is used only in the presence of purulent bile. When drainage is used upon such an indication a smooth rubber tube, instead of a "T" tube, is directed up toward the hilus of the liver to avoid injury to the duct on removal. This is usually withdrawn about the tenth day. A tube is inserted down to Morison's pouch, whether or not the common duct is drained, because accessory ducts may open directly into the gall bladder and discharge a small quantity of bile. This type of drainage is removed in from twenty-four to forty-eight hours.

Common-duct stones are a serious complication and carry a higher surgical risk than cholecystectomy. The mortality in 417 gall-bladder operations was 1.2 per cent, compared with 13.2 per cent in 151 cases of common-duct stones and 15.2 per cent in 46 cases in which secondary exploration was done.

The symptoms of carcinoma of the common-bile duct are discussed. The value of palliative short-circuiting procedures for the relief of obstructive jaundice due to malignant disease is stressed. The locations of carcinoma of the gall bladder and bile ducts in the author's patients are listed.

ROBERT ZOLLINGER, M.D.

Åkerberg, E.: Hyperinsulinism and Surgery. *Acta chirurg. Scand.*, 1939, 83: 104.

The symptoms and causes of spontaneous hypoglycemia and the surgical indications and procedures therefore are discussed. The causes are: (1) hyperfunction of an apparently normal pancreas, (2) endocrine disorders of extrapancreatic origin, (3) malignant tumors of the liver and pancreas, and (4) islet adenomas of the pancreas. The removal of an islet adenoma in a forty-six-year-old woman is described.

It is the author's opinion that surgery should be withheld in hypoglycemia if the patient presents symptoms of an endocrine disorder. If a patient in good condition suddenly develops hypoglycemic attacks, the cause is apparently in the pancreas, and is either hyperfunction or an islet adenoma. Surgery should be done if the attacks are severe, especially when they are not controllable by dietary measures. At operation the pancreas is mobilized along the lower border so that it can be palpated. Islet adenomas are most commonly in the body and tail; they are rather small and have a reddish-blue appearance. Silk suture material is used instead of catgut because the latter is rapidly digested by the pancreatic tissue. It is the author's impression that if a circumscribed adenoma is not found at exploration, a partial resection of the pancreas should not be done as results from this procedure have not been satisfactory.

ROBERT ZOLLINGER, M.D.

Pratt, J. H.: Acute Pancreatic Necrosis. *New England J. Med.*, 1940, 222: 47.

A case of fulminating acute pancreatitis is described which was treated conservatively and was cured. The author is of the opinion, on the basis of statistics presented by various authors, that conservative treatment rather than an operative procedure is indicated in dealing with acute pancreatic necrosis. As the disease is not an infection but an intoxication in which trypsin and split-protein products are absorbed by the lymphatics and blood vessels of the pancreas, it would seem evident that this absorption cannot be prevented by any operation, but might on the other hand be increased because of incision or manipulation of the pancreas.

SAMUEL H. KLEIN, M.D.

MISCELLANEOUS

Soli, D.: So-Called Peritonitis Due to Hepatic Autolysis. Experimental Contribution (La così detta peritonite da autolisi epatica. Contributo sperimentale). *Clin. chir.*, 1939, 15: 867.

According to the literature, the study of hepatic autolysis, caused by inclusion into the peritoneal cavity of pieces of liver taken from the same animal or from other animals, has revealed that a peculiar form of peritonitis develops, which has been called "autolytic peritonitis"; its development has raised many discussions, some authors claiming a toxic origin and others an infectious factor. This peritonitis has been made solely responsible for the death of the experimental animals.

In order to clarify the subject, Soli made his experiments on dogs and rabbits in which he resected a piece of liver, weighing from 20 to 40 gm., and left it to autolyze in the peritoneal cavity. In the first group, he searched for peritoneal lesions caused by hepatic autolysis after a lapse of ten days, which was insufficient time to allow regression or disappearance of the lesions and sufficient for the development of eventual bacteria. In the second group, he searched for initial lesions and the early development of bacteria, the animals being killed on the fifth day. In the third group, he tried to establish the degree of pathogenicity of the bacteria developed in agar (Veillon) cultures of fragments of autolyzed liver by injecting into the peritoneal cavity from 5 to 10 c.cm. of a bouillon culture of the bacteria, and to determine whether the bacteria had emigrated from the intestine or were originally

present in the liver by introducing pieces of boiled or autoclaved (130° C.) beef and flaps of aponeurosis and muscle taken from the animal itself into the peritoneal cavity, and pieces of liver into the anterior abdominal wall properitoneally.

Except for the findings in the omentum, which in nearly all cases presented characters similar to those observed in subacute peritonitis, and except for the presence of peritoneal exudation in 1 dog, no other element could be found that suggested the presence of peritonitis. The intestinal functions of the animals which died spontaneously were normal up to the time of death and no dilated loops were observed at necropsy. The changes found in the omentum were not specific for hepatic autolysis as they were present to the same degree and with the same characters in the animals in which pieces of sterilized beef or flaps of aponeurosis and muscle had been used. The foreign body was usually surrounded by the omentum or by omentum and intestinal loops, and, in some cases, adhered to the parietal peritoneum; it showed the various stages of destruction corresponding to the time elapsed since its introduction into the abdominal cavity.

Cultures of fragments taken from pieces of liver to be introduced into the peritoneal cavity were regularly negative after four or five days of incubation at 37° C., but those of exudate, autolyzed liver, and substance surrounding it revealed the presence of bacillus perfringens, associated in 1 case with bacillus coli. These bacteria had caused the development of a small quantity of fetid gas in 1 rabbit and a bad odor of the autolyzed piece of liver in a few cases, but these occurrences may have been due to post-mortem putrefaction. Cultures of boiled or autoclaved pieces of beef and of flaps of aponeurosis and muscle were negative; this proved that the bacteria found did not come from the intestine, but were originally present in the liver of the dogs and rabbits, although with such a reduced vitality as to require autolysis for their demonstration. Whether the autolysis must take place in the peritoneal cavity or in any other part of the body is a question of secondary importance. In fact, the properitoneal inclusion of a piece of liver in 2 rabbits did not give rise to any noteworthy local or general signs, but subsequent culture of the pieces was negative in 1 case and showed the presence of bacillus subtilis in the other; evidently, conditions for autolysis are not as favorable in the abdominal wall as in the peritoneal cavity. Cultures of the omentum were also negative. Intraperitoneal injections of 5 and 10 c.cm. of bouillon culture of the bacteria developed on agar Veillon did not cause any disturbances, and necropsy of the animals after five days did not reveal the slightest trace of peritonitis.

Consequently, hepatic autolysis does not cause peritonitis and is very seldom responsible for death whether in the clinic or in the laboratory. The livers of dogs and rabbits contain bacteria in the latent stage, mostly bacillus perfringens and bacillus coli; they can be demonstrated only by endoperitoneal hepatic autolysis, are non-pathogenic even when developing in the peritoneal cavity, and lose their virulence while migrating from the intestine to the liver.

RICHARD KEMEL, M.D.

GYNECOLOGY

UTERUS

Rouhier, G.: Radical Cure of Complete Prolapse of the Uterus; Total or Subtotal Colpectomy with Vaginal Hysterectomy and Perineorrhaphy (La cure radicale des gros prolapsus génitaux; colpectomie totale ou subtotale avec hystérectomie vaginale et plastie perinéo-vulvaire). *J. de chir.*, 1940, 55: 1.

After presenting his criticisms of the previously described operations for relief of complete prolapse of the uterus the author states that he performs the radical cure of this condition not only in aged females but also in those still menstruating, by a three-stage operation: (1) total or subtotal colpectomy, (2) vaginal hysterectomy, and (3) perineorrhaphy.

The colpectomy is always total anteriorly and more often subtotal posteriorly. This is because the rectocele even in complete prolapse is of less frequent occurrence and of less importance than cystocele. Vaginal hysterectomy with some practice and except in the rare case of a large and irregular body of the uterus does not increase the time or difficulty of the operation. The third part of the operation, the perineorrhaphy, results in a more normal appearance of the genitalia instead of the gaping vulva which follows simple colpectomy.

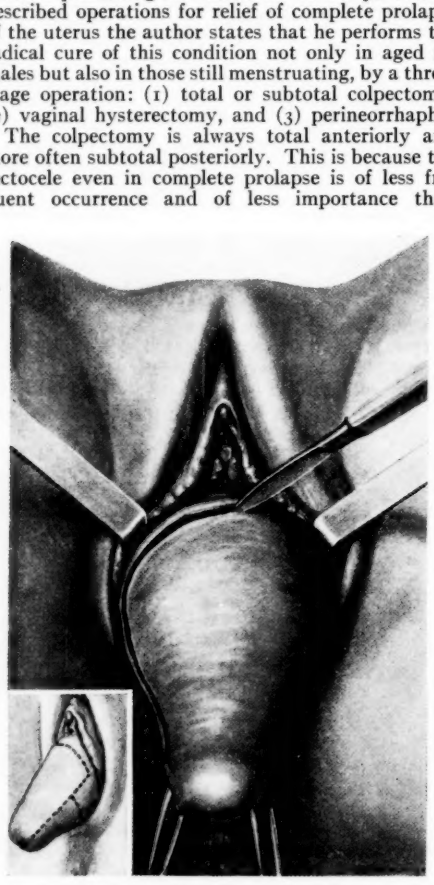


Fig. 1. Anterior line of incision for the colpectomy. The assistant exposes the operative field by traction in various directions upon the forceps attached to the cervix. Inset reveals the type of incision (as shown by the dotted line) in the vaginal mucosa when one desires to leave a small vagina.

The author has practiced this procedure in a large number of cases, his first operation being done twenty years ago, and has had no recurrences. Moreover, the small vagina that he produces in the case of relatively young females has apparently been sufficient for sexual intercourse. An additional advantage is the fact that the entire procedure is performed by the vaginal route which diminishes the risk in aged females. He has performed the procedure successfully in women seventy-two, seventy-six, and even seventy-eight years of age. General anesthesia is considered preferable for relatively young women and spinal anesthesia for the older women.

The technique of operation is described and illustrated. The first stage, the colpectomy, consists briefly of the incision of the vaginal mucosa, as shown by the dotted lines in the accompanying illustration (Fig. 1) and careful peeling off of the mucosa as far down as the cervix anteriorly and posteriorly. The second stage, the vaginal hysterectomy, is performed after freeing of the bladder from the uterus anteriorly and the rectum posteriorly. The uterine vessels are exposed and severed between ligatures. The peritoneal cavity is opened and the body of the uterus is delivered, usually anteriorly. After severance of the broad ligaments between ligatures, the uterus is freed of its attachments and removed. The peritoneum is then closed; interrupted sutures of catgut are used to approximate the bladder and rectum, and finally the anterior and posterior mucosal edges of the vagina are similarly sutured. The third stage of the operation consists of suture of the levators and perineorrhaphy as usually performed.

Since 1924, the author has performed this operation in 59 cases and has had only 1 death from pulmonary embolism. The results have been very satisfactory in all the cases. MICHAEL DEBAKEY, M.D.

Maliphant, R. G.: The Complications of Radium Therapy in Cancer of the Uterine Cervix. *J. Obst. & Gynaec. Brit. Emp.*, 1939, 46: 873.

The complications after radium therapy in 650 cases of cancer of the uterine cervix varied with the type of treatment and with the extent of neoplastic growth. In the earlier years, the interstitial technique with needles and relatively thin screenage (0.5 mm. of platinum) was employed, but more recently the cavitary technique with radium in a uterine tube 1.5 mm. platinum has been used.

There was a primary mortality of 2.6 per cent, the most common cause of death being peritonitis. In the moderately early cases serious after-effects were exceptional, while in the advanced cases treatment was much more hazardous. Direct effects upon the bladder and rectum were not notable, for vaginal packing was used to protect these areas as much as possible.

Of the inflammatory sequelae, pyometra occurred 8 times, and was found to be much more frequent after employment of the cavitary technique. Only one of the patients developed pyometra because of stenosis; this did not occur until seven years after treatment.

There were 12 fatal infections, in which death occurred within one month of the first treatment. Peritonitis accounted for 8 of these deaths. Ten patients in this group died after the cavitary method of treatment, and it was found that the needling of an infected, ulcerating region did not predispose to the spread of organisms as much as the former method; hence the uterine tube was omitted when the external os could not easily be located.

Four deaths were due to postirradiation collapse, the causes of which are not entirely clear, but it is thought by many to occur as the result of an intoxication from the absorption of disintegrating proteins. Intestinal obstruction was seen as a late sequela of carcinoma, and was due usually to neoplastic extension, and rarely to irradiation.

The author states that there is a wide variation in the figures of various authors on the incidence of fistula in irradiated cervical cancer. Three hundred and fifty cases were followed for a minimum period of five years, or previous to death. In this group there were 20 rectal, 13 vesical, and 6 rectovesicovaginal fistulas—a fistula incidence of 11 per cent. The fistulas all occurred in the presence of active disease at an average interval of ten months after the first and seven months after the last irradiation, and 80 per cent appeared within three years of initial treatment. It is believed that cases should be watched for some months before the absence of fistulas is reported. Fistulas were more than three times as common after needling than after other methods of application, and re-irradiation was very likely to result in fistulas.

The greatest danger of sequelæ lay in the far advanced lesions, for these were heavily infected and anatomical alterations had taken place. Great care is necessary to prevent disastrous after-effects in these cases. E. S. Burge, M.D.

ADNEXAL AND PERIUTERINE CONDITIONS

Bernhart, F.: Concerning a Twice-Recurring Granulosa-Cell Tumor (Ueber ein zweimaliges Rezidiv eines Granulosazelltumors). *Zentralbl. f. Gynaek.*, 1939, p. 1338.

The author reports on a case in which a granulosa-cell tumor recurred twice and in which the tumor before removal had hormonal symptoms in the form of irregular bleeding. After thirteen years, the first recurrence appeared without hormonal changes. Such a long period free of recurrence is often observed in these cases. The first time the left ovary was removed, the second time the right. After three additional years, another recurrence set in although the entire internal genitalia had been removed. This time the tumor was located on the right retroperitoneally and, since it lay directly in the area of the genital ridge, could be considered as having arisen from an ovarian rest. As a matter of interest there was another tumor of the same type in the pelvis minor which perhaps could be interpreted as a metastasis. It definitely underwent autonomous growth although the chief symptom of malignancy, invasiveness, was lacking. The tumor did not proliferate into surrounding tissues. From the description of this implantation the picture of gelatinous pseudomyxomatous peritonitis naturally arises since in these cases gelatinous masses cover the peritoneum and frequently can be wiped away by the hand during the operation. On loosening of this tumor, however, a few tiny blood vessels were torn through, which indicated that the tumor, not malignant histologically, was more malignant than a pseudomyxoma. The two recurrences which lacked hormonal symptoms and the peritoneal implantation show that the condition was not entirely benign.

(H. Fuchs). Ronald R. Greene, M.D.

MISCELLANEOUS

Hamblen, E. C., Powell, N. B., and Cuyler, W. K.: The Metabolism and Utilization of Progesterone Given Intramuscularly to Women. *Am. J. Obst. & Gynec.*, 1939, 38: 557.

Studies have been reported upon the endometriotropic responses of 23 patients with functional irregularities of uterine bleeding during 99 of 117 cyclic series of therapy with progesterone alone, or progesterone combined with estrogens. During 30 cycles in 4 of these patients, and during 10 cycles in an additional group of 3 patients similarly treated, urinary titers of sodium pregnandiol glucuronide were determined.

The endometriotropic data warrant the conclusion that crystalline progesterone, when administered intramuscularly in oil to women with functional irregularities of uterine bleeding is inefficiently utilized. Six of the 7 patients studied were also unable to utilize efficiently their intrinsic progestin despite the existence of evidence that it was being metabolized normally.

The intramuscular administration of crystalline progesterone to these patients resulted not only in no increases in their urinary titers of the pregnandiol-complex, but also in apparent decreases. These observations suggest that incomplete metabolism occurred. Some of the various factors which may influence the metabolism and utilization of progesterone are discussed.

Edward L. Cornell, M.D.

Repetti, M.: Researches on the Relation Between the Sex Hormones and the Development of Tumors (Ricerche sui rapporti fra ormoni sessuali e sviluppo dei tumori). *Folia demograph. gynaec.*, 1939, 36: 527.

The author reviews the more recent investigations regarding the various endocrine glands and their influence upon the growth of tumors induced by transplantation, by the action of tar, or by the synthetic polycyclic hydrocarbons. He presents results obtained from a series of animals, mature and immature, male and female, castrated and uncastrated, some of which were treated with male or female sex hormones. The carcinogenic agent employed was a 0.5 per cent solution in benzol of 1–2 benzpyrine, which was administered in some cases by topical application and in others by subcutaneous injection. From 8 to 12 animals were placed in groups, and several normal animals were used as controls. Each group was housed in a separate cage and kept under identical circumstances. The object of the study was to observe the behavior of tumors produced by benzpyrine in the presence and in the absence of folliculin and of testosterone propionate. Careful data were kept on the mortality, the incidence of neoplasms, and time of development, with emphasis upon modifications of the female genitalia.

It was found that the topical application of benzpyrine in young mice resulted in the development of prickle-cell tumors in the uncastrated animals in the same percentage of cases and after the same length of time as in the castrated animals. In female rats topical application of the tar product produced no changes worthy of mention, while the subcutaneous application of the substance in oil tended to produce tumors at the site of the injection. In the latter group, treatment with folliculin appeared to favor the new growth, although there was no change in the rate of incidence. The male hormone had no effect. In both the castrated and uncastrated female rats treated with benzpyrine alone, the uterine mucosa was found to be indistinguishable from that of the controls. In uncastrated rats which were treated also with folliculin, a thickening of the stratified epithelium and a tendency toward stratification were observed; these, however, disappeared after three months. In castrated rats treated with folliculin and injections of benzpyrine in the uterine mucosa, syncytial and proliferative polypoid structures, showing cornification and flattening of the columnar cells lining the glands, were noted. At the end of three months the proliferative changes had largely disappeared, and only the degenerative elements were left; this indicated a functional origin. The male hormone similarly employed produced hypertrophy of the uterus, with thickening of the lining epithelium and dilatation of the glands. After three months, regressive changes occurred as in the folliculinized cases. Fibromyomatous degeneration was not found. Syncytial hyperplastic changes were not present in this group. In no case were malignant changes found in the breasts or elsewhere.

In summarizing his conclusions, the author finds the evidence insufficient to attribute to folliculin a carcinogenic action. EDITH FARNSWORTH, M.D.

Navarrete, E., and Kaelin, D. G.: Inflammatory Neoplasms of the Female Urethra (Las neoformaciones inflamatorias de la uretra femenina). *An. de la clin. quir.*, Lima, 1939, 1: 10.

Inflammatory neoplasms of the female urethra are not rare, according to Navarrete and Kaelin; they constitute about 6.5 per cent of all affections of the uropoietic system, 1.5 per cent being located at the meatus, while 5 per cent are bladder-neck affections. As to their origin, neoplasms of the meatus probably are caused by infectious genital processes, while those of the bladder neck, though occasionally perhaps of chronic gonorrheal origin, probably are caused by an enterorenal syndrome of which little is understood. Urethral neoplasms of the female are limited chiefly to patients between twenty and fifty years of age; their inflammatory character, which is obvious clinically, is also borne out histologically, as the authors show with photomicrographs.

As to the symptoms, these neoplasms often are accompanied by most severe subjective complaints, apparently out of all proportion to the size of the lesion.

In lesions of the meatus, the pain is rarely spontaneous, but it is easily produced by external influences, such as examination, cohabitation, or the traction produced by the urinary stream; in other cases, by muscular tenesmus following micturition. Hemorrhages usually are slight, and are often mistaken for irregular menstrual bleeding. They, too, often are elicited by external influences. Dysuria and pollakiuria are frequent in the daytime, but temporary urinary retention, due either to "tumoral" obstruction or spasm, is rare.

The authors report the case of a woman of sixty-four years who was hospitalized with complete retention. The condition was diagnosed as a fibroid tumor of the uterus, and the patient was operated on accordingly. At operation the "tumor" proved to be the distended bladder. The retention was caused by multiple congested "tumors" of the meatus, enlarged to the size of a small egg. Electrocoagulation resulted in complete cure.

Among the genital disturbances, vaginismus is not infrequent. General disturbances, which are chiefly of a neurotic or mildly anemic character, are rare. If the meatal tumors are not obvious upon physical examination, the meatal labia should be spread, pressure should be exerted upon the anterior vaginal wall from behind, or urethroscopy should be employed.

Among the symptoms produced by neoplasms of the bladder neck are pain, frequency, and urinary changes strongly resembling the changes found in cystitis. A cloudiness of the urine is frequently caused by the afore-mentioned enterorenal syndrome, and bacilli coli, enterococci, or staphylococci may be found, but often the urine is completely clear,

even when marked frequency of micturition and pain are present. Clear urines may be either bacteriuric or sterile, and the "cystitis" purely mechanical, caused by sphincteric neoplasms. Hemorrhage and obstruction also occur, though rarely, and the general disturbances are less than in the cases of meatal tumors.

Endoscopic examination by means of an indirect urethroscope of the McCarthy urethroscope type requires more time and study than routine cystoscopy. It reveals several different aspects of the neoplasm, the chief forms being: (1) polypoid, (2) cystic, (3) edematous, (4) vascularized excrescences, and (5) small round elevations. Differential diagnosis is necessary to rule out hypertrophy of the urethral mucosa, prolapse of the urethral mucosa, prolapse of the lower part of the urethra, epithelioma, and polypus.

The authors' treatment in cases of meatal involvement consisted of dilatation and instillations, designed to cure the accompanying urethritis; anesthesia with 0.5 per cent procaine hydrochloride (apparently as local infiltration); and the application of the high-frequency current at the base of the lesion. In neoplasms of the bladder neck, the bladder was anesthetized by means of a 4 per cent cocaine solution, and the lesion was destroyed through McCarthy's urethroscope by electrocoagulation. The subjective results as well as those revealed by endoscopic check-up were excellent in all cases.

HEINRICH LAMM, M.D.

Buengeler, W., and Silveira, D. F.: Pathogenesis of Endometriosis (Considerações sobre a patogenia das endometrioses). *Arq. de cirurg. clin. e exper.*, 1939, 3: 169.

In a thirty-nine-year-old woman endometriosis of the small intestines produced ileus. In the nodules a premenstrual hyperplasia of the endometrial tissue was found. In a forty-two-year-old woman the diagnosis of endometriosis of the pleural cavity was established microscopically. The condition was combined with fibroblastic pleurisy. In a thirty-seven-year-old pregnant woman with primary carcinoma of the pleura there was evidence of transformation of the decidual uterine mucosa.

While in the first case a dissemination of the endometrial tissues from the genital organs was probably responsible for the intestinal ileus, in the last 2 cases the author suspected a real metaplasia of the pleura which probably took place under the influence of endocrine stimuli. JOSEPH K. NARAT, M.D.

Janisch-Rašković, V.: Statistical Reports on 2,065 Cases of Malignant Tumors of the Female Genital Organs (Statistische Berichte ueber 2,065Faelle von boesartigen Geschwuelsten der weiblichen Geschlechtsorgane). *Ztschr. f. Krebsforsch.*, 1939, 49:29.

The paper contains a report on 2,065 malignant tumors which were observed in the years from 1920 to 1935 in the First and Second Gynecological and Obstetrical Clinic and in the Roentgen and Radium Institute of the Belgrade State Hospital. The frequency of the malignant tumors of the female genitalia in the years from 1920 to 1923 amounted to 219 cases (5.8 per cent of the gynecological material); from 1924 to 1932 to 1,012 cases (10.1 per cent), and from 1933 to 1935 to 833 cases (15.6 per cent). This numerical increase does not result from an absolute increase in cases of cancer, but rather from the greater number of patients treated following the opening of the Roentgen Institute in 1924 and of the Radium Institute in 1932. There was an increase in the inoperable cases and also an extension of the territory from which patients were brought to Belgrade. Jugoslavia has only two x-ray institutes which have radium at their disposal, one in Zagreb and one in Belgrade. Patients with cancer from the eastern half of the country are treated in Belgrade, those from the western half in Zagreb. In the years from 1920 to 1923, the territory from which Belgrade derived its cancer patients included 45 districts; from 1924 to 1932, following the introduction of deep x-ray therapy, 93 districts; and from 1933 to 1935, after the opening of the Radium Institute, 137 districts.

There were 1,868 cervical carcinomas, of which 768 were histologically verified; most of them originated from the epithelium of the portio, 26 (3.2 per cent) from cervical glandular and cylindrical epithelium (24 and 2 cases, respectively). Carcinoma of the cervical stump was found 7 times; the author regarded only 3 of the cases to be definite. Carcinoma of the corpus uteri occurred 64 times (3.3 per cent of the uterine and 3.15 per cent of all the carcinomas); primary ovarian carcinoma 37 times (1.83 per cent), including 2 malignant dermoid cysts; metastatic ovarian carcinomas 4 times (2 with carcinoma of the stomach and 2 with carcinoma of the uterine fundus). There were 19 (0.94 per cent) primary carcinomas of the vagina, 26 (1.3 per cent) of the vulva, and 1 (0.05 per cent) of a tube. Many cases from 1920 to 1924 were not histologically examined (from 10 to 15 per cent), the diagnosis resting on the clinical picture and on the early death of the patient. Thirty-four sarcomas (1.64 per cent) were represented in the entire series of malignancies: 18 of the uterus (including 2 of the cervix), 14 of the ovary, and 2 of the vulva; these were all histologically verified with the exception of 2 uterine sarcomas. Sarcomas represented 1.36 per cent of the desmoid uterine tumors. The author places these figures somewhat higher actually, as not all uterine tumors regarded as myomas were histologically verified, and 17 of the patients died following operation or radiation under circumstances pointing to malignancy. Moreover, 24 cases of malignant abdominal tumors were not operated on, among which were undoubtedly sarcomas of the uterus.

Benign and malignant ovarian tumors occurred in the following numbers: 589 ovarian tumors, 498 of these were epithelial, of which 37 (7.04 per cent) were carcinomas, 36 desmoids, 14 sarcomas, and 3 probably sarcomas (not histologically examined). Thus, approximately every second desmoid tumor was malignant. Embryonal tumors were represented

by 55 cases: 1 teratoma, 52 benign, and 2 (3.8 per cent) malignant degenerated dermoid cysts. Actually, the number of malignant epithelial ovarian tumors is significantly higher. If the anatomically benign, but clinically malignant serous papillary cystomas, as well as a few cases not histologically examined, are included, the percentage rises to 17.8 per cent.

Combinations of malignant tumors were found in 4 cases: 2 of squamous-cell carcinoma of the portio with malignant unilateral ovarian tumor; an ovarian carcinoma was found in 1 of these with pulmonary metastases of a cervical carcinoma at autopsy; in the other, the ovarian carcinoma was not histologically verified. There were 2 cases of squamous-cell carcinoma of the portio associated with adenocarcinoma of the breast; in 1, the latter was found nine years after a successful operation for carcinoma of the cervix; in the other, the cervical lesion appeared three years after operative removal of a mammary carcinoma which had shown no evidence of recurrence in the meantime.

The statistics demonstrate the following relationships between uterine myoma and carcinoma: coexisting myomas were found among 21 of 1,861 cases of carcinoma of the cervix and among 13 of 408 operative cases, a percentage of 3.1 per cent. Myomas were found with 8 of 64 corpus carcinomas, but with 8 of only 37 operative cases (24.1 per cent). Among 1,337 cases of myoma, of which 779 were operated on and 99 underwent curettement and in the remainder the condition was determined only by palpation, there were 21 (1.5 per cent) cervical and 8 (0.59 per cent) corpus carcinomas. This percentage is presumably higher, for among the myomas not operated on were those cases which ended fatally soon after discharge from the hospital. A squamous-cell carcinoma of the vulva accompanied a uterine fibroid diagnosed only by palpation. A uterine fibroid was found to coexist with a squamous-cell carcinoma originating in a dermoid cyst.

Further statistics tabulated from the literature are compared with those presented in this paper.

(V. Janisch-Raškovič). O. Theodore Roberg, Jr., M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Wellen, I.: Specific "Toxemia," Essential Hypertension, and Glomerulonephritis Associated with Pregnancy. *Am. J. Obst. & Gynec.*, 1940, 39: 16.

A workable classification for the so-called toxemias of pregnancy is presented by the author.

The dangers of toxemia are immediate and remote. If the condition progresses notwithstanding conservative medical treatment, the pregnancy should be terminated. The frequency with which essential hypertension follows toxemia of pregnancy has caused growing concern. While toxemia may induce persistent hypertension, it is possible that the pregnancy merely makes evident a latent hypertensive state. It is incumbent upon obstetricians to recognize that such a state may supervene. Therefore, a careful decision must be made when the advisability of future pregnancies following one complicated by toxemia is considered.

The imminent and future dangers of a pregnancy complicated by pre-existing essential hypertension should be discussed with the family. If the patient has living children, the pregnancy should be terminated and future ones avoided. Not infrequently the method of choice for termination is hysterotomy with tubal sterilization. Fifteen of 69 such pregnancies were terminated by abdominal operation. Ten women underwent tubal sterilization. Pre-existing glomerulonephritis is rare during pregnancy. It usually becomes complicated by specific toxemia. The second stage of labor should be shortened by simple forceps delivery in order to prevent cerebral injuries in premature children and to forestall progression of the toxemic state. The maternal mortality rate is high, the uncorrected rate in this series being 2.8 per cent. There was a total fetal mortality rate of 30.8 per cent. EDWARD L. CORNELL, M.D.

LABOR AND ITS COMPLICATIONS

Calkins, L. A.: Occiput Posterior: Incidence, Significance, and Management. *Am. J. Obst. & Gynec.*, 1939, 38: 993.

Occiput-posterior and occiput-anterior presentations occurred with about equal frequency in the series of 2,130 cases which the author reviews, in which more than the usual care was taken to arrive at an early and accurate diagnosis. The occiput-posterior presentation was characterized by a somewhat longer first stage of labor. The difference, however, was not more than from one to one and one-half hours, and the first stage in the occiput-right-posterior presentation was probably not much, if any, longer than in the occiput-anterior presentation. The difference in the second stage is a matter of a few minutes only. Operative delivery, particularly low-forceps delivery, is more frequent in the occiput-left-posterior presentation than in the other three positions by about 3 cases in each 100. Fetal mortality is no greater in occiput-posterior presentations than in occiput-anterior presentations under the plan of management employed for this series. No pituitary extract was given previous to the delivery of the placenta and the anesthetic was confined to nitrous-oxide plus morphine on indication. Maternal morbidity was about 3 per cent greater for occiput-left-posterior presentations than for the other 3 positions. Spontaneous internal rotation occurred in about 94 per cent of the occiput-posterior presentations as compared with not more than 96 per cent of the occiput-anterior type. Inasmuch as nearly half of the unrotated babies were delivered spontaneously without injury to the mother and without a single fetal death, the problem of failure of spontaneous internal rotation would seem to be not greater than 3 per cent for occiput-anterior presentations and 3.5 per cent for occiput-posterior presentations.

The author's present attitude toward the latter is identical to his attitude toward the former, except that he realizes that patience to the extent of about one hour more of waiting is required.

EDWARD L. CORNELL, M.D.

Movers, F.: The Obstetrical Significance of Pelvic Fractures (Die geburtshilfliche Bedeutung der Beckenfrakturen). *Arch. f. Gynaek.*, 1939, 169: 1.

To a summary of deliveries after old pelvic fractures the author adds a similar case from the Cologne Clinic. The patient was a twenty-year-old secundipara who had been run over by an auto in Aug. 1933.

The roentgenogram taken after the accident showed a portion of the left superior pubic ramus broken off up to the obturator foramen, in addition to a fracture of the left inferior ramus of the ischium and a considerably broader fracture in the left sacro-iliac articulation. Other fracture lines were found in the right body of the pubis and in the right superior pubic ramus. On admission into the clinic in Nov. 1934, the pregnancy was almost at term. In the roentgenogram taken at this time it was found that during healing there had been exuberant callous formation which projected into the left half of the pelvis. This marked callous formation had led to a narrowing of the left half of the pelvis. The fractures of the right half of the pelvis were well healed. After an eleven-hour labor, a living child weighing 4,350 gm. and 54 cm. long was born spontaneously from cranial presentation II. Further course was uneventful.

The conduct of a delivery after a healed pelvic fracture is dependent upon the condition caused by either callous formation or approximation. Ac-

cording to the site and size of the pelvic obstruction one must endeavor to determine whether natural birth is possible or whether cesarean section is necessary. In borderline cases of the latter type, too much delay must not be permitted.

The course of labor in the case of a pelvic fracture not yet healed was demonstrated in a thirty-six-year-old primipara who had been run over by a truck and was admitted to the clinic in the ninth month of pregnancy. The roentgenogram showed a fracture between the right inferior ischial ramus and the right inferior pubic ramus. A vertical fracture line ran through the right pubis. The left pubis was completely shattered. Four weeks after the accident, following premature rupture of the membranes and a six-and-one-quarter-hour period of labor, a living child of 3,330 gm. and 51 cm. length was delivered spontaneously. After seven weeks in bed a roentgenogram showed that gross changes in the pelvis had occurred either during or after parturition. The left pelvic inlet had enlarged because of a sinking of the left superior pubic ramus. The fragments of the left pubic ramus were not well approximated. The patient was released from the surgery clinic four months later with an almost completely healed pelvis. In the right ischium, however, healing was incomplete.

Delivery was managed expectantly in these cases, by which method a favorable result was obtained for both mother and child. The healing tendency of the pelvic fracture before the birth was very poor.

Another case of fresh pelvic fracture was that of a twenty-nine-year-old secundipara with a seven to eight months' pregnancy who had an auto accident. Immediately after the accident the fetus died. Four weeks later, after a five-and-one-half-hour labor, a necrotic fetus was delivered in breech position. Only after the puerperium was the fracture discovered. The roentgenogram showed a bilateral break between the inferior ischial ramus and the inferior pubic ramus with dislocation and, in addition, bilateral breaks in the superior pubic rami. The patient was able to walk perfectly. Operative procedure was unnecessary also in this case.

(Theo Puetz). Ronald R. Greene, M.D.

MISCELLANEOUS

Browne, J. S. L., Henry, J. S., and Venning, E. H.: The Significance of Endocrine Assays in Threatened and Habitual Abortion. *Am. J. Obst. & Gynec.*, 1939, 38: 927.

The evidence suggests that there are two sources of progesterone and estrogens in pregnancy in the human being. These are the ovary with corpus luteum and the placenta. The authors interpret the rise in pregnandiol excretion which occurs from about the seventieth to ninetieth days in most normal cases as being due to the beginning of secretion of progesterone by the placenta. It was previously thought that, since the corpus luteum degenerates in many instances about the third month and since the ovaries could be removed and pregnancy continue, progesterone was unnecessary in the latter part of human pregnancy. This view is no longer tenable. Whether all the pregnandiol in late pregnancy is derived from progesterone, and what the minimum level necessary for the maintenance of pregnancy is, are unknown. The time at which the transfer of function occurs from ovary to placenta varies in different individuals and in the same individual in different pregnancies. If, however, the corpus luteum ceases to produce progesterone for any length of time before the placenta begins to secrete it, abortion will follow. The time at which a deficiency of corpus-luteum hormone is most likely to occur is therefore in the transition period between the ovarian and placental phases (late in the second and in the third months); this is the critical period of pregnancy.

Some corpora lutea are more readily maintained by pregnancy-urine extracts than others, and some may be more readily maintained by chorionic gonadotrophic substance in early pregnancy. The cause of many abortions as mentioned is a faulty gestation from the first; the chorion partakes in this abnormality and produces an amount of gonadotrophic substance inadequate to prolong the corpus luteum beyond a certain point. In other patients in whom the gestation is less abnormal, the function of the corpus luteum may be prolonged for the usual time and the embryo develop normally, but the placenta may be slow in taking over. In either case abortion follows. Patients in whom either of these conditions repeatedly occurs habitually abort.

In those patients with abortion in whom the gestation is degenerate before the onset of symptoms, the administration of progesterone is obviously useless when symptoms appear. A large proportion of these are abnormal from the first, and even if therapy is started before symptoms appear, the result will be unsatisfactory. The patients in whom the embryo and placenta develop up to a certain period and the placenta takes over the function of progesterone formation late or the corpus luteum degenerates early, offer theoretically the most hopeful outlook for progesterone therapy, since in many, if the critical period can be tided over, the placental function begins and further therapy is unnecessary. It is possible that the determination of prolan excretion in early pregnancy may enable one to distinguish patients in whom the gestation is already degenerate from those in whom therapy might be of benefit.

From the pregnandiol assays, it seems obvious that the amount of progesterone produced by the corpus luteum up to the seventieth or eightieth day is from 5 to 10 mgm. per day, and that the placenta produces a gradually increasing amount as pregnancy advances. It would seem that doses of less than 5 mgm. are unlikely to have much effect. This dose should be given daily, or every other day, and may be increased in the cases of patients presenting persisting symptoms.

Edward L. Cornell, M.D.

Otto, H.: Fetal Hydrops (Zur Kenntnis Hydrops fetalis). Goettingen: Dissertation, 1939.

Congenital hydrops, icterus gravis, congenital anemia, and erythroblastosis constitute an associated disease picture and are based on a disturbance in the development of the hematopoietic system. The diagnosis of icterus gravis neonatorum or congenital anemia cannot be made before birth. The number of pathological presentations is much increased in the presence of congenital hydrops, the increase being in pelvic and transverse presentations. Delivery is made difficult by the ease with which the fetus tears. On attempted forceps extraction it is not unusual for the head to be torn from the trunk. Traction on the arms, foot, or leg may also lead to tearing. Because of the rounded hydropic body strong pressure is exerted on the Frankenhaeuser ganglia. This results in marked weakening of the labor pains. The placenta is very edematous. This frequently causes delay in its separation and because of its fragility there is likely to be considerable hemorrhage. These difficulties in delivery and in the period immediately following birth have not been observed in children with icterus gravis or congenital anemia. In most cases of congenital hydrops the children are born dead; they die either shortly before or during labor. There is a mortality of 100 per cent. The prognosis for the mother is favorable if the delivery is properly conducted. Children who develop icterus gravis neonatorum die, for the most part, a short time following birth. Congenital anemia is seldom found to be fatal.

In the preventive treatment of congenital hydrops the mother is put on a milk diet. The proposal has been made to treat the hydropic child itself by irradiation of the liver with small doses of roentgen rays in order to check the abnormal blood formation and gain time for the child's liver tissue to develop, increase, and become functionally adequate. Puncture of the hydrothorax has also been recommended. No case has yet been reported in which a child suffering from congenital hydrops has been kept alive. For icterus gravis neonatorum, blood transfusions, liver extracts, and iron are recommended. The same basic principles apply to the therapy of congenital anemia. The etiology is not clear. Von Gierke has pointed out the familial character of these three diseases, evidenced by the fact that they are frequently found in several children of the same family. Nephritis and infections in the mother are mere chance coincidences. Familial erythroblastosis of the newborn is said to be a disease of the Scandinavian race and this is borne out by statistics. Scattered cases have been reported, nevertheless, from France, Spain, Portugal, Italy, Poland, Russia, Japan, China, and the United States of America. In the United States cases have occurred in Negro children. The following is an interesting parallel in animals: five monsters (hydrops congenitus) were born in a cow-barn, the cows of which had been covered by a certain bull. When the use of this bull was discontinued, no more monsters were born.

Three cases of hydrops congenitus in man are reported. (Froboese). Florence A. Carpenter.

GENITO-URINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Smith, E., and Orkin, L.: The Renal Digestive Reflex. *J. Urol.*, 1940, 43: 1.

The authors point out the frequency with which various lesions of the urinary tract give rise to symptoms of the intestinal tract, and after a brief historical review of the literature they show that 10.2 per cent of the 487 cases reviewed revealed a urinary tract lesion after a diagnosis of intestinal tract pathology had been made. This 10 per cent had been diagnosed as dyspepsia, biliary disease, appendicitis, or intestinal obstruction. Illustrative examples with the urological workup are cited.

Since the upper urinary tract and a great part of the intestinal tract receive their innervation from the same source the authors believe it reasonable to assume that pathology in one organ may give rise to symptoms in another. The reflex nervous mechanism is demonstrated and the authors advise a plain urogram in all cases undergoing routine gastro-intestinal study. A complete urological workup is often desirable. DONALD K. HIBBS, M.D.

Fernandez, M.: Malformations of the Kidney (Le malformazioni del rene). *Arch. ital. di urol.*, 1939, 16: 287.

Fernandez presents his observations gathered from the Clinica Urologica of the University of Milan, and groups them under the following headings: anomalies of number, anomalies of form, ectopic kidneys, and anomalies of structure. The total number of malformations discovered among 10,000 cases studied was 72, or 0.72 per cent, a figure which is in contrast to the 2 per cent reported by Israel, 3 per cent by Fedorow, and 11 per cent by Gottlieb. Among the 72 cases, there were 29 double, 4 horseshoe, 12 disc, 18 ectopic, 2 crossed ectopic, and 8 hypoplastic kidneys.

Total absence of both kidneys is a condition incompatible with life and hence devoid of special urological interest; interesting, however, is the implied fact that the fetus does not depend upon the urinary tract for its excretory function. This fact is explained by the arterial pressure, which is less than half that of the newborn, while the venous pressure is much higher; this results in a pulse pressure inadequate for filtration through the glomeruli. Absence of both kidneys may occur in conjunction with other congenital defects, or it may be unsuspected. If one kidney only is lacking, it is ordinarily found that ureter and renal vessels are also absent, and that the bladder shows no sign of a ureteral opening. The disease processes involving the single kidney are the usual ones, and the value of the diagnosis lies in the avoidance of surgical intervention.

Explanations of the cause of the double kidney are numerous and hypothetical. In general, the organ is elongated and larger than normal, and the superior one is frequently hypoplastic. There are two complete pelves; the ureters may be bifid or double, on one or both sides. The arterial supply is ordinarily from the aorta, rarely from the iliac artery, and may spring from a single or a common trunk. That the doubled kidney has a special tendency toward morbidity is manifested by figures ranging from 30 to 37 per cent, the disturbances most commonly found being hydronephrosis and pyonephrosis due probably either to mechanical factors or to functional factors concerned with the synchronization of peristalsis. Tuberculosis and calculi are no more common in the double than in the normal kidney. The most common symptom is pain, which varies from a mild disturbance to the most violent pain, which may radiate anteriorly or into the groin; for the most part the lesion is made manifest by the superimposed disease, and the diagnosis is confirmed by cystoscopy and urography. The treatment is determined by the arterial distribution and by the morbid form.

The horseshoe kidney, like the double kidney, is a relatively frequent anomaly, discovered most often through the disease which attacks it. A horseshoe kidney which is free of disease may give rise to Rosving's syndrome, a triad consisting of (1) nervous disturbances, (2) disorders of digestion which may be manifested by nausea and vomiting or alternating constipation and diarrhea, and (3) abdominal pain believed to be due to pressure exerted by the isthmus on the sympathetic nerves; it appears likely, however, that this syndrome is the result of even slight stasis. The treatment of this entity will be determined by secondary disease. If the kidney is not involved, division of the isthmus is usually sufficient.

The sigmoid kidney is an extremely rare form in which the lower pole of one kidney is united to the upper pole of the other. Other fusion forms occur rarely, the most significant of which is perhaps the disc kidney, in which rotation and flattening fashion an organ peculiarly susceptible to pathological processes; it is usually revealed by hematuria, hydronephrosis, and calculi, which may be visualized with the x-rays.

Of the ectopic forms, the homolateral pelvic ectopy is the most frequent; the crossed form, in which one kidney is displaced to the opposite side, is the rarest. The clinical diagnosis is difficult to accomplish; once made, except in the case of the crossed form, surgical intervention is the treatment of choice.

The hypoplastic kidney is not in itself a cause for concern except for the avoidance of surgical intervention on the healthy one. The congenitally hypoplastic kidney may be distinguished from the acquired type by the pyramids which are apt to be

well preserved. The symptoms of the condition are not characteristic, and the diagnosis is ordinarily made only at operation. The hyperplastic form is usually compensatory. EDITH FARNSWORTH, M.D.

McIver, R. B.: Plastic Surgery of the Renal Pelvis. *J. Urol.*, 1939, 42: 1069.

Obstructions at the ureteropelvic junction are divided for the purposes of treatment into two groups: (1) those that are relieved by cystoscopic dilatation, and (2) those that require surgical intervention. The latter must be further subdivided into those that require only division of bands and disposition of polar vessels, those that need some plastic procedure later, those that require resection of the pelvis with reimplantation of the ureter, and those far advanced cases which require nephrectomy. Conservative application of surgery to hydronephrosis requires early complete diagnosis. It is remarkable how a poorly functioning kidney will recover with the institution of adequate drainage. Open operation relieves obstruction, preserves the blood supply, establishes dependent drainage, and fixes the kidney in its proper position.

Non-operative treatment consists of overdilatation by a dilating bulb in the end of the ureteral catheter and the check-up by pyelography of the diminution in the size of the hydronephrosis. The operative treatment, however, is often necessary and the author's experience with 50 cases of hydronephrosis thus treated is summarized:

Complete exposure of the renal pedicle is necessary. If this is done thoroughly the pelvis and upper ureter will be freed from all constricting bands and such aberrant vessels as may exist will seldom need to be divided. Occasionally such a vessel will have to be sacrificed, care being taken that the vessel is not the major arterial supply to the organ. The ureterostomy-nephrostomy catheter splint is necessary.

When plastic procedures are necessary in addition to the releasing of bands and the pressure of aberrant vessels, many ingenious operations have been devised, and in his cases the author has selected the operative procedure to fit the conditions found. The more radical operations are reserved for those cases not amenable to simple procedures. The best results are obtained by excision of the pelvis to within 1 cm. of the hilum so as to effect closure of the remaining pelvic walls without undue tension. In closure of the pelvis and anastomosis of the ureter to the pelvis the following points are observed:

1. Atraumatic sutures of very fine catgut, 00000 to 000 are used; they should not perforate the mucous membrane, should be few in number, and should be firmly but tightly tied.

2. A nephrostomy tube with a ureteral catheter splint should be routinely employed.

3. Nephropexy should be done to maintain the position of the anastomosis.

The ureteral splint is removed in ten days but the nephrostomy drainage should be maintained for several weeks and until retrograde catheterization of the ureter and pelvis has been accomplished. The follow-up treatment is equally important. The pelvis should be drained and lavaged at regular weekly intervals and the ureteropelvic anastomosis should be kept dilated until check-up pyelography shows a fairly normal result. In this series of 50 cases there were no nephrectomies and only 1 death.

ELMER HESS, M.D.

Bothe, A. E.: Pyelonephritis in Children and Adults with Hypertension. *J. Urol.*, 1939, 42: 969.

Hypertension has been produced experimentally by compression of the renal artery. Recent studies show that simple saline extracts of kidney tissue produce unpredictable effects, which may be toxic depressor or pressor; these extracts always diminish the skin temperature conspicuously when injected in crude form. However, the toxic and depressor fractions can be removed, to yield a solution which elevates the blood pressure without reducing the peripheral blood flow. It has been suggested that the severity and persistence of the effect of renal ischemia depends upon the ratio of the ischemic to normal renal tissue. The pathological lesions which are known to impair the renal blood supply are: (1) pyelonephritis; (2) nephrosclerosis; (3) congenital anomalies which impair the blood supply; (4) polycystic kidneys; (5) hydronephrosis, arterial compression; (6) infarction; (7) canalization of a thrombus in the renal artery; (8) intramural renal-artery tumors; (9) periarteritis nodosum; and (10) arteriosclerotic plaques. Five cases are cited with the hope of fostering further interpretation of this complex problem.

CASE 1. A girl, aged seven years, complained of "vomiting attacks" with abdominal pain on the left side and fever for three years occurring about every six months. These attacks gradually increased in frequency up to every two or three weeks. There was definite tenderness to the left of the umbilicus and upward to the costal margin. Laboratory studies and roentgenography led to the diagnosis of left hydronephrosis. Left nephrectomy was done and a large hydronephrosis with extensive pressure destruction of the renal parenchyma due to an aberrant vessel at the ureteropelvic junction was found. Blood-pressure studies showed diastolic readings of from 85 to 90 mm. Hg and systolic readings of 130 mm. Hg. These meager data are very suggestive of hypertension. The blood pressure four and one-half years after nephrectomy was normal.

CASE 2. A girl, aged eight years, complained of repeated sore throat. At the age of three a kidney infection followed one of these attacks and on admission to the hospital the urine still contained clumps of pus cells. A slightly tender mass was felt in the upper left quadrant of the abdomen, which was thought to be the kidney. The urine from the left kidney contained many leucocytes and culture

showed the staphylococcus aureus. Pyelography revealed a large polycytsic kidney on the left side with beginning polycystic disease in the right kidney. Blood-pressure readings for four months showed a gradual increase from 128/86 to 145/115. In this case both kidneys were involved, the left more than the right. The associated pyelonephritis of the left kidney may have contributed in precipitation of the hypertension. The hypertension persisted after the infection had apparently subsided.

CASE 3. A girl, aged ten years, gave a history of nephritis and was admitted to the hospital for convulsions, loss of sight, headache, and vomiting. There had been a mucopurulent nasal discharge and frequency of urination for a year. Within twenty-four hours the patient died and the autopsy revealed hemorrhage in the frontal lobe, a small and atrophic right kidney with a dilated pelvis, and a hypertrophic left kidney. Both ureters were moderately dilated. The bladder was trabeculated and the internal sphincter contracted. Microscopically, the renal parenchyma showed advanced nephritis and nephrosclerosis. The obstructive lesion at the vesical neck probably contributed to the renal changes.

CASE 4. A woman, aged fifty-three years, complained of an abdominal mass, which had existed for four months. She had had high blood pressure for several years. Five months previously she suffered a paralysis of the left side of the body, from which she partially recovered. The abdominal mass extended from under the ribs to the pelvic brim and to the midline of the body. Urinalysis revealed many pus cells but no casts. Intravenous urography revealed a non-functioning left kidney with calculi. At operation a calculous pyonephrosis was removed. Microscopically, marked pressure atrophy of the renal parenchyma was found. Postoperatively, there was a slight but gradual reduction in the blood pressure. Recovery followed and the blood pressure was 140/80.

CASE 5. A boy, aged three years, was admitted to the hospital for frequent "head colds." The physical examination was essentially negative. The blood pressure was 174/120. Urinalysis revealed a faint trace of albumin and occasional pus cells. Intravenous pyelography showed a slightly dilated pelvis and calyx bilaterally, more marked on the left side. There was definite constriction at the vesical end of the left ureter. Cystotomy was done, the contracted ureteral orifice was dilated and incised, the bladder was partially mobilized, and the lower ureter freed. Convalescence was uneventful and the blood pressure gradually diminished. Intravenous pyelography six days after operation showed greater dilatation of the calyces of the left kidney, with no evidence of an opaque substance in the ureter. Although the postoperative urogram indicated complete blockage on the left side, since no sutures were used near the ureter, it was assumed that the block was due to edema, which will eventually subside. If the blood pressure again rises, the ureter will be explored for evidence of constricting fibrous bands, aberrant vessels, or intramural fibrosis. The reduction of blood pressure was probably due to relief of obstruction of the left ureter.

The diagnosis depends upon careful and skillful utilization of all the methods well known to the urologist. The cases reported illustrate advanced unilateral kidney lesions (excepting Case 5). Hypertensive patients should always have complete urological examinations, especially when extensive sympathectomy, celiac ganglionectomy, or splanchnic-nerve resection are contemplated.

Two pressor substances, tyramine and renin, occur in renal extracts. Of all the known substances which raise the blood pressure, certain kidney extracts containing renin alone produce circulatory changes in animals which are characteristic in human hypertension. However, these kidney extracts elevate the blood pressure for from thirty to forty-five minutes, whereas experimental or spontaneous hypertension is permanent. Final conclusions on the relationship between hypertension and pressor material in the kidney tissue should be postponed until certain important factors have been studied more thoroughly: such as (a) the amount of active material in the circulating blood, rather than the amount in the kidney tissue, (b) the possible protective action by normal kidney tissue, (c) the activation or inhibition of activity by antagonistic substances in other tissues or in the circulating blood, and (d) changes in sensitivity or reactivity of the blood vessels themselves. At present it appears that the humoral mechanism which produces hypertension may depend upon several interactive factors rather than upon the concentration of any single substance. LOUIS NEUWELT, M.D.

Reid, R.: Observations on the Healing of Renal Tuberculosis. *Brit. J. Urol.*, 1939, 11: 305.

Although it has been recognized for some years that sufficient laboratory evidence exists to justify the assumption that tuberculous infections established in the kidneys may heal, authorities upon the subject are not yet agreed that healing of such lesions in the human subject has been satisfactorily demonstrated on clinical grounds. In this article it is intended to point out certain features of interest in the pathology of renal tuberculosis which have arisen in the course of the investigation and treatment of a series of about 70 cases of genito-urinary tuberculosis. Five cases are presented, and in 4 of them one may be tempted to assume that healing of established lesions has taken place.

It is important to recognize that two distinct types of lesions exist in the kidney, although one is really an early stage of the other, and that the natural history of a renal tuberculous lesion from its earliest stages develops along certain definite and continuous lines. There is only one possible route of infection of the genito-urinary system and that is by the blood stream. By what paths the infection once estab-

lished in the system spreads from one part to the other, from the epididymis to the kidney, for example, is of interest and some importance practically. Some believe it spreads by lymphatic channels, others, by the blood stream, and yet others hold that direct extension or descending urinary infection is the method by which tuberculosis eventually extends throughout the whole genito-urinary system.

The initial lesion in the kidney consists of a group of tubercles in the renal bed which have not undergone caseation; at this stage resistance may overcome the infection, and all that remains is a small scar in the renal filter. On the contrary, the disease may spread to form the second, a more advanced lesion, which is characterized by ulceration and cavitation, and indicates that the natural resistance has not succeeded in its fight against the tubercle bacilli. This lesion progresses and eventually the caseous cavity ruptures into the renal pelvis and the kidney proceeds on an irreversible journey towards destruction. Advanced renal tuberculosis of this type is known as an ulcerocavernous kidney. The particular importance of the distinction between the two types of lesions lies in the possibility of spontaneous healing.

So far the mass of experimental evidence produced supports the assumption that the presence of tubercle bacilli in the urine, especially when associated with pus cells, means that there is a tuberculous lesion in the renal bed. The number of bacilli does not seem to bear much relation to the extent of the renal lesion, but, on the other hand, it has been found in this series to be approximately true that the quantity of pus in the urine is a rough index of the extent of the tuberculous process in the kidney, or of the destruction brought about by it.

The 5 cases reported in this article were submitted to routine investigation of the pulmonary, skeletal, and genito-urinary systems, and at various intervals during the patients' stay in the Sanatorium and after their discharge certain investigations were repeated. One of the most important methods of investigation of the urinary system is cystoscopy and separation of the kidney urines by ureteral catheterization. An accurate determination of the contents of the urine specimens from the right and left kidneys is of the very first importance, as any contamination of these specimens by bladder urines would vitiate results and any conclusions based upon these results. This danger of contamination has been met by careful bladder lavage before the catheters are passed through the viscus; furthermore, a continuous stream of solution is maintained up the catheters until they have been inserted several centimeters into the lower end of the ureters.

Regardless of whether renal tuberculosis is secondary to some pre-existing lesion in the body, such as a pulmonary or bone focus, the bacilli must be conveyed to the kidneys by the blood-stream. There is no logical reason to assume that insemination by this route is not evenly distributed and therefore bilateral. Although bilaterality is in all likelihood a constant occurrence, its discovery may vary with the promptness and care with which urological and bacteriological investigations are carried out. The passage of time and the patients' natural resistance may in some cases obscure the initial bilateral distribution by reason of healing in one or the other kidney.

The development of renal tuberculosis, like that of the same disease in other tissues, depends primarily upon the degree of resistance of the whole organism to the infection. It does not appear to be dependent upon any local abnormality in the kidney. It is, however, influenced in its progress by the supervention of secondary septic infection. It is probable that both obstruction and secondary infection hasten the destruction of the kidney, but not necessarily of the individual.

The cases in this article are examples of bilateral disease. Three patients had evidence of tuberculosis outside of the genito-urinary system, while the remaining 2 first had tuberculosis in the epididymis and then in the kidneys. One had no evidence of disease in the bladder and no frequency; the other 4 had bladder changes and frequency as their initial symptoms. On examining the various specimens of urine it was noted that whenever tubercle bacilli were discovered either on direct examination or by guinea-pig inoculation, pus cells were found also. In 2 cases the tuberculous pyuria was associated with gross interference with the ability of the kidney to excrete urea or uroselectan. In general, this extreme interference with function has been found to be an unusual accompaniment of tuberculosis in the kidney. Developing ulcerocavernous lesions do not seem to affect the general renal function to such an extent that uroselectan excretion is delayed. Even when there is a severe breakdown of renal substance there is usually a sufficient excretion of uroselectan to give a reasonable x-ray shadow. In those cases in which the uroselectan and urea output is very greatly diminished, it is probable that the tuberculous process is more in the nature of a toxic nephritis, because no ulcerocavernous change occurs and the kidneys recover to a remarkable extent in function.

With regard to the x-ray appearances, the most advanced changes are, of course, calcifications in the whole of the affected kidney. Local calcifications have not been observed. Next in the x-ray evidence comes gross deformity in the pyelogram shadows due to the excavations of an ulcerocavernous lesion. Any form of irregular deformity may be seen, provided the opaque medium has sufficient concentration. In general it has been found that sufficient detail can be obtained by excretory pyelography. If, however, fine detail is required, ascending pyelography must be employed, but with this procedure there is the possibility of causing dissemination.

Before actual gross destruction of the renal substance has taken place, that is, before an ulcerocavernous lesion has developed, certain appearances in the pyelogram other than diminished excretory

power can be observed. First, the pelvis may be seen to be slightly dilated, the infundibula to be open, and the calyces rounded or even clubbed. The thin line connecting the calyx with the pelvis which indicated the contracted infundibulum is no longer seen, and the appearance suggests that there is an interference with the contractile function as though the whole pelvis and calyx system were stiff. This appearance in the excretory pyelogram has been observed to be associated with tuberculous infiltration of the mucosa and submucosa of the renal pelvis, infundibula, and calyces. Second, dilatation of the lower end of the ureter is always an ominous sign. This is probably due to tuberculous infection of the mucosa, submucosa, or muscular layers. The change described in the calyx system and the dilatation of the ureter have been noted both in kidneys which have gone on to destruction and in those which have undergone clinical cure.

Once infection of the kidneys has occurred, the development and spread of the disease is dependent primarily upon the degree of resistance of the body to tuberculosis. Thus, renal disease differs essentially in no way from other forms of systemic tuberculosis. The degree of resistance is dependent upon the patient's natural resistance, backed up by the well-recognized therapeutic measures. Of these measures constitutional treatment holds the first place, and its place is well recognized in the fields of pulmonary and skeletal tuberculosis as the first line of defense.

The mass of clinical and experimental evidence indicates that the presence of tubercle bacilli in the kidney urine is an assurance of renal disease. Whether the presence of bacilli, even associated with pus cells, is an indication for nephrectomy, is a question which warrants further study. The number of bacilli bears no relation to the extent of the lesion; only careful urological survey can define how far the destruction has progressed.

Renal tuberculosis should receive the same consideration and care given to other forms of systemic tuberculosis. The patient should be put upon a general constitutional régime from the first and no pains should be spared to discover the exact significance and extent of the renal lesion. When once an operation is decided upon it should be an incident and nothing more in the course of constitutional treatment and this must be sufficiently prolonged to raise the patient's resistance to the highest possible level. C. TRAVERS STEPITA, M.D.

Di Giacomo, A.: A Contribution to the Diagnosis and Treatment of Solitary Abscess of the Kidney (Contributo alla diagnosi e cura dell'ascesso solitario del rene). *Arch. ital. di urol.*, 1939, 16: 207.

Di Giacomo describes the solitary abscess of the kidney with respect to its pathogenesis, pathological anatomy, symptomatology, diagnosis, course, and treatment, and presents 7 cases in which the diagnosis was proved at operation. The origin of infection was believed to be hematogenous in some cases while in others the infection appeared to have ascended from the lower urinary tract. All the patients were thoroughly examined before surgical intervention, 6 of 7 having undergone cystoscopic examinations and all having had pyelograms, either intravenous or retrograde. Histories and routine laboratory procedures were complete in all cases. The author offers the following conclusions:

1. It is not always plausible to attribute the appearance of the renal abscess to a true suppurative focus elsewhere in the body.

2. The etiological agent concerned in such abscesses is most frequently the staphylococcus, rarely the bacillus coli.

3. It is evident that, at least in the metastatic cases, the fibrous capsule is not invaded, and the involved portions are apt to be situated in the cortex.

4. With regard to the symptoms, pain, fever, and leucocytosis are the most striking and constant.

5. Examination of the single or collected urine is frequently without diagnostic significance.

6. Roentgenological evidence may be of assistance in the event of ptosis, deformities of the pelvis, or amputations of the calyces.

7. Treatment must be selected in the light of the pathogenesis of the lesion, and must be individually selected when the kidney is exposed. In general, lesions which are not too extensive and which do not communicate with the lower urinary tract are best treated by capsulectomy and drainage; those, on the other hand, in which there is communication from the abscess cavity to the pelvis and ureter require nephrectomy. EDITH FARNSWORTH, M.D.

Kretschmer, H. L.: Retroperitoneal Lipofibrosarcoma in a Child. *J. Urol.*, 1940, 43: 61.

Fatty tumors of the retroperitoneal space—the pure lipomas, the fibrolipomas, and the histologically benign and the frankly malignant varieties—are usually considered as a group. They are subject to secondary degenerative and malignant changes in advanced growths, and to recurrences. The neoplastic fat is frequently found in combination with other tissues of connective-tissue origin, and when this occurs the tumors are described as fibrolipomas, myxolipomas, chondrolipomas, or fibromyxolipomas. In case malignant changes are demonstrable the tumor becomes either a sarcoma, a liposarcoma, or a lipofibrosarcoma.

In the majority of cases these retroperitoneal tumors come to clinical observation during the fourth and fifth decades, and their cause, similar to that of lipomatous tumors elsewhere, is not determinable. The finding of such a tumor in a child, as reported in this paper, is an altogether rare experience. A search of the literature revealed only 6 cases reported as lipoma, the last occurring thirty-two years ago (1908). Aside from the natural interest stimulated by the unusual, there is added importance in the thought that apparently, at least in certain cases, these tumors are perhaps congenital

in their origin. A very careful review of the literature has failed to reveal a case similar to the one reported here.

The cause of lipomas, like that of other neoplasms, is unknown. A hereditary influence has been mentioned. Ewing notes that the occurrence of multiple symmetrical lipomas has suggested to many a connection with the peripheral nervous system, adding "yet the occurrence of lipoma with multiple neuro-fibroma is extremely rare, and it has not been possible to establish for lipoma such a relation to the peripheral nerves as exists for fibroma. A congenital tissue predisposition seems to be an essential factor in the origin of most lipomata. This predisposition may take the form of a disturbance of development of the fat tissue."

It is generally noted that the age of greatest frequency for retroperitoneal lipomas is from forty to sixty years; also, that these tumors may reach enormous proportions. One of the largest reported was the case of Hirsch and Wells in which the tumor weighed 69 lb. Recurrences are relatively frequent with growths that are histologically benign. In certain cases the recurrences of benign tumor (from the standpoint of histology) show malignant changes.

As regards the point of origin, one may say that this is frequently hard to determine, beyond the fact that the tumor arises in the retroperitoneal space. When the tumor comes to clinical observation and operation, it has, in the average case, reached huge dimensions and fills much of the retroperitoneal space. There is a general tendency to regard all such tumors as simply retroperitoneal, rather than to try to distinguish those arising from the root of the mesentery, or those which are perirenal in origin.

As a result of the growth of the retroperitoneal lipoma, secondary changes may occur in the urinary tract which may lead to complete destruction of the kidney. Displacement and compression of the ureter may result in hydronephrosis. A large retroperitoneal lipoma may envelop the kidney so that pressure atrophy results, or the kidney may undergo more or less dilatation because of obstruction at the ureteropelvic junction or below that point. Not infrequently a retroperitoneal fatty tumor surrounds the kidney and its pelvic structures so completely, that the removal of the mass necessitates a nephrectomy. Metastases are not common in this group of tumors. Neinhaus reports 1 case of a retroperitoneal liposarcoma with metastases to the long bones, spine, mediastinum, and pelvic glands.

In the majority of reported cases the tumor had caused no symptoms until it reached such a size that abdominal swelling was noted, or until it produced pressure symptoms on various organs (most usually the digestive or urogenital tracts). A patient with a retroperitoneal lipoma may give the general impression of having lost weight, but not infrequently the actual weight remains the same, or increases, the latter being true because of the capacity of lipomatous tumors to store up fat despite extreme emaciation on the part of the patient. Not infrequently the patient has noted a slowly progressive enlargement of the abdomen for years, but feeling entirely well, has not sought medical attention until pressure symptoms occur, when destruction of the vital organs has already occurred.

A study of the literature regarding retroperitoneal fatty tumors shows a mistaken diagnosis prior to operation in the vast majority of cases. However, it should be remembered that most of the cases reported did not have the benefit of modern methods of urological diagnosis. In the problem of diagnosis and differential diagnosis, modern urological diagnosis plays a most important rôle from two points of view: (1) in establishing the fact that the tumor is retroperitoneal and that it has a relationship to the kidney, and (2) in demonstrating changes in the kidney due to the presence of the tumor, and the renal function before operation is undertaken. Since the problem concerns itself with the differentiation between intraperitoneal and retroperitoneal tumors, and with renal and extrarenal lesions, one or more of the following—intravenous, retrograde, lateral, and stereoscopic pyelograms—should be taken. In view of the fact that the ureter is so frequently displaced, the use of the shadowgraph catheter is most informative. Changes in the course of the ureter are most significant, and were present in the case reported here, as well as in a similar case seen in an adult. This displacement or rotation of the kidney in a normal pyelogram is a valuable and additional point of information. Finally, hydronephrosis, if present, is equally informative.

Radical extirpation constitutes the only possible treatment of retroperitoneal lipomatous tumors. Since it is a fact that in most cases symptoms are absent until the growth has attained a huge size, the operation is necessarily a very difficult one, with adhesions frequently encountered, and the close proximity of the growth to important structures and to large blood vessels. The immediate operative mortality is high, because of the frequent occurrence of shock from hemorrhage (injuries to spleen, liver, vena cava) and from long operative procedures; and among the later complications causing death, peritonitis, necrosis of the intestines, phlebitis, pneumonia, and pulmonary embolism are frequently listed. The value of irradiation in the treatment of these tumors is problematical, but this means should be employed pre-operatively for large tumors and postoperatively in most cases, particularly when the tumors show sarcomatous changes or may be classed as mixed tumors. C. TRAVERS STEPITA, M.D.

Crenshaw, J. L.: Ureter with Extravesical Orifice; Supranumerary Ureter Ending Blindly; Crossed Ureteral Ectopia; Stones in Extrapelvic Cystocele: Report of 11 Cases. *J. Urol.*, 1940, 43: 82.

In a previous report the author (with Buchtel) estimated that the anomaly of extravesical ureteral orifice had been diagnosed in approximately 1 of 130,000 cases in patients who had registered at the

Mayo Clinic. In that previous report, it was suggested that the increased use of excretory urography had increased the number of anomalies that are found. In the present report, Crenshaw believes that the proportion relative to extravesical ureteral orifice is now 1 in 81,150 patients.

Buchtel noted that up to May 1, 1939, 13 instances of extravesical ureteral orifice had been encountered at the Mayo Clinic. Several facts are of interest from the diagnostic standpoint:

1. The high percentage (12 of 13) of females in the series implies either that the condition is rare in the male or, as is more probable, that the diagnosis is being missed when the ureter opens into a seminal vesicle, the prostatic urethra, or the rectum.

2. In this series, as in others, nearly all of the aberrant ureters serviced kidneys with duplicated pelves and always the upper pelvis was serviced by the aberrant ureter. In only 1 case in this series was the renal pelvis not duplicated. There was only 1 case of bilateral duplication, and in this case the ureters from both upper pelves led to the urethra.

3. The segment of the kidney served by the aberrant ureter is usually small and, with the destruction and dilatation secondary to the anomalous position of the ureter, renal function and even the amount of urine secreted may be greatly reduced. For these reasons many of these upper pelves are not readily seen in an excretory urogram; therefore, if a diagnosis of duplicated pelvis and ureter is to be made, dependence must be placed largely on the presence of an elongated renal shadow and on the larger than normal amount of this shadow which lies above the upper calyx of the lower segment. Usually the pyelogram of the lower segment alone, by contour and position, suggests duplication, but occasionally the outline of the lower pelvis cannot be distinguished from that of a kidney which is not duplicated. The reduced function, likewise, makes the excretion of methylene blue, and other agents, unreliable as an indication of the location of the aberrant orifice.

4. In several cases in which the ureter opened into the urethra, cystoscopy disclosed slight relaxation of the vesical sphincter, which had been construed as the cause of the urinary incontinence.

5. The actual ureteral orifice is not always easy to find, even after most careful examination, and often after its existence has become apparent from other data. For this reason, and especially if pyuria or other symptoms are present, the patient usually has had varied medical, and often surgical, treatment before the correct diagnosis has been made. It is not, however, necessary to find the aberrant orifice to make a diagnosis. The evidence of duplication in the excretory urogram, whether the upper segment is visualized or not, and the fact that the orifice of only 1 ureter is found on either side, in the bladder, is enough to justify a diagnosis of aberrant orifice, and to warrant surgical exploration if incontinence or other symptoms are sufficient.

In 1931 and 1933 Crenshaw reported a total of 3 cases of unusual ureteral anomaly; namely, 2 cases of abortive development of the upper end of the ureter and 1 case in which a ureter, opening into either side of the bladder, came from a duplicated left kidney, while another ureter, opening into the right base, came from the right kidney. Since these cases were reported he has had 3 more patients with abortive development of the ureter.

Crenshaw has encountered 1 new case of crossed ureteral ectopia (as distinguished from those in previous reports) in which there was a solitary kidney (agenesia?) on the right. The ureter crossed to the left side and was implanted in the left side of the bladder, in the position normal for implantation of the left ureter.

In fine, Crenshaw added to the literature reports of 6 new cases of aberrant ureter with extravesical orifice, 3 new cases of abortive development of the ureter, and 1 new case of crossed ureteral ectopia.

The number of reports of these anomalies is relatively small.

He would emphasize the necessity of making an excretory urogram in all cases of unexplained urinary incontinence. Following this, careful cystoscopy should be performed. Particular attention should be paid to whether the proportion of the renal shadow that is above the upper calyx indicates the probability of the existence of duplication of the pelvis.

The urologist always should bear in mind the possibility of anomalies of the urinary tract so that, when indicated, he can perform the special examinations necessary to diagnose them positively.

Thompson, G. J., and Kibler, J. M.: The Treatment of Ureteral Calculus with Particular Reference to Transurethral Manipulation. *J. Am. M. Ass.*, 1940, 114: 6.

According to the authors, no method has yet been developed to anticipate and prevent the formation of a ureteral calculus.

They report the experiences encountered and results obtained in a series of 361 cases of ureteral calculus in which the patient was subjected to transurethral manipulation, during the interval from January 1, 1930, to December 31, 1938, inclusive. This number, of course, does not include all the cases of ureteral calculus seen during that interval of time. An almost equal number of patients was treated expectantly because of the small size of the stone, the lack of symptoms, the existence of inoperable malignant neoplasms in other organs, the apparent possession of a peculiar ability to pass stones spontaneously, or, for fancied physical, social, economic, and sometimes undisclosed reasons, the patient refused to follow the advice given. In an almost identical number of cases ureterolithotomy was advised rather than transurethral manipulation.

The series of 361 cases included all patients subjected to any transurethral manipulation of a ureteral stone with the exception of simple diagnostic ureteral catheterization.

Among the 361 cases in which the patients were accorded transurethral methods of treatment, 28 per

cent had stones which measured 5 mm. or less in their greatest diameter; 19 per cent had stones with diameters which varied between 5 and 10 mm.; 46 per cent with diameters of from 1 to 2 cm., and 2 per cent with diameters slightly more than 2 cm.; in 5 per cent, unfortunately, the size of the stones was not recorded. Review of these cases emphasizes the opinion expressed before: that of greater importance than the size of the stone, when considering transurethral methods of removal, is the size of the ureter in which it lies. It is a relatively easy matter to pass catheters or extractors alongside a stone contained in a large ureter, and often an impossibility to pass a catheter alongside a tiny stone in an undilated ureter. Things which prevent ready access to the ureter, such as an enlarged prostate gland, a fixed hip, a marked urethral stricture, pelvic tumors, uterine fibroids, pregnancy, and other factors, might affect a decision to manipulate a stone even though on the basis of size of the calculus alone the condition might seem a suitable one for this procedure.

The position of the stone is of some importance in considering the advisability of transurethral manipulation. As a general rule it is wise to let the stone descend to the lower third of the ureter, although the authors have in some instances removed stones from the ureteropelvic juncture and from within the renal pelvis. With few exceptions, if the patient is unwilling to wait for the stone to descend, a ureterolithotomy done through a lumbar incision is a wiser choice than transurethral manipulation.

When the stone is situated just above or within the bladder wall the chances of removing it by manipulation are usually good. In most instances when the stone is located in the upper two-thirds of the ureter it is best to rely on its spontaneous descent rather than try transurethral manipulation. The passage of a catheter or injection of oil into the ureter occasionally will speed the descent of the stone but there is some risk of introducing infection. Therefore, as was true in many of the cases recorded at the Mayo Clinic, ureterolithotomy is preferable to spending two or three or more weeks waiting for the stone to get down to a position favorable for transurethral manipulation.

The authors are agreed that transurethral manipulation of a ureteral calculus either with multiple catheters or with any of the various extractors is a hospital procedure and should never be done in an office. Ureteral catheterization, the injection of oil, and the dilatation of the ureter with small bulbs are permissible office methods, but as a matter of fact we seldom employ them and prefer manipulation in the hospital.

The use of an anesthetic, such as pentothal sodium given intravenously, is wise practice, for ureteral spasm which will defeat one's efforts will generally develop if an attempt is made without an anesthetic.

It is well to make a postoperative roentgenogram to prove that the stone has been removed.

In 246 of the 361 cases in which transurethral manipulation was performed, the entire stone was withdrawn from the ureter and presented to the patient when he or she awoke from the anesthetic. In 12 other cases the largest part of the stone was withdrawn but a small fragment which passed later was visible in the postoperative roentgenogram. In 103 cases the stone was not obtained at the time of manipulation. In 35 of these cases the stone was passed within a few days and in 28 more it was passed within a period of several weeks. During this time the great majority of patients were comfortable, and when the stone finally passed the pain involved was, as a rule, less than that which was experienced prior to manipulation. Thus it is evident that the procedure dilated the ureter and assisted passage of the stone. In 9 other cases it seems likely that the stone passed, inasmuch as the patients thought it did but were unable to recover it for close inspection; since that time they have been free of all pain. In 4 cases the evidence seems to point to failure because, when last heard from, the patient stated that to his knowledge the stone had not passed. In the remaining 27 cases ureterolithotomy was done after manipulation had failed, in 2 of these after the patient had left the Mayo Clinic.

Pain will almost never be experienced if, according to the authors, catheters are left inlying in the ureter after manipulation. Following their removal, or even before, in rare cases, fever may develop. Only rarely (2.7 per cent of the 361 cases) does this become alarming and cause one to wonder whether infection has developed in the renal pelvis or renal cortex.

Severe complications such as periureteritis, thrombophlebitis, pulmonary infarcts, and pyelonephritis of more than a few days' duration were exceptionally rare, being confined to but a few patients who survived after appropriate treatment was instituted.

Of great importance to the patient is the hospital cost involved in getting rid of the offending ureteral calculus. In those instances in which the initial attempt at extraction has failed and additional transurethral manipulation is advised the time consumed will soon equal that which would be required for convalescence from a ureterolithotomy. The anticipated disappointment of the patient over the failure to remove the stone should not influence the cystoscopist to the point of persisting with efforts at removal which might result in ureteral injury. Extreme gentleness in the insertion of extractors is essential if complications are to be avoided. The patient should be told at the outset that open surgical operation may be necessary after manipulation has been attempted. Unless he consents to this it is probably better to let him try to pass the stone without cystoscopic aid. Generally after a few colics he will be willing to co-operate.

The authors believe that attention should again be called to the fact that renal function is often temporarily much reduced in cases of ureteral calculus in which the stone is tightly impacted. At the time of acute colic and for an interval thereafter

an excretory urogram will entirely fail to delineate the renal pelvis and calyces. The erroneous conclusion might be drawn that the kidney is entirely functionless and that nephrectomy is therefore the procedure of choice. Practically all urologists have encountered such cases and are aware that following cystoscopic or open surgical removal of the impacted calculus renal function is quickly resumed and in many cases there is practically no evidence of hydronephrosis. The kidney in such cases must temporarily stop its physiological activity. It should be emphasized that the excretory urogram is only one link in the chain of evidence in any urological disorder; this is true particularly in ureteral calculous disease, and operative treatment should not be instituted until a competent urologist has reviewed the excretory urogram. Unless this practice is adhered to, many kidneys will be sacrificed unnecessarily.

In this series of 361 cases in which the patient was subjected to transurethral manipulation there were no deaths which could be directly attributed to the methods employed. The only death which occurred was that in 1 case in which transurethral methods were unsuccessful and ureterolithotomy was done immediately. This patient seemed, during the second week of convalescence, well on the way to recovery when a massive pulmonary embolism occurred and she died within a few minutes.

Ureteral calculi will pass spontaneously in about one-third of the total number of cases encountered; in approximately the same number transurethral methods of extraction are justified and advisable; for the other third ureterolithotomy or other open surgical methods seem best.

Ureteral stone extractors, if carefully used, will be of distinct aid in removing the stone at the time of manipulation.

If the condition present is suitable for the use of a metallic stone extractor this instrument will readily enter the ureter and quickly engage the stone. Repeated attempts to engage the stone should be avoided for they will usually result in ureteral trauma and lead to complications.

The morbidity following proper transurethral methods is slight and the mortality is extremely low.

In the large majority of cases the opinion of a urologist should be obtained before a decision is made as to the course of treatment which should be instituted for a patient who has ureteral calculus.

MISCELLANEOUS

Kunstadter, R. H.: The Treatment of Hypogenitalism in the Male with the Gonadotropic Principle of Pregnant Mares' Serum. *Endocrinology*, 1939, 25: 661.

Fourteen boys between the ages of six and one-half and fourteen and three-quarter years, who presented hypogenitalism, cryptorchidism, or both, were treated by the intramuscular administration of pregnant mares' serum.

Definite improvement as evidenced by growth of the genitalia, the appearance of secondary sex characteristics or descent, partial or complete, of undescended testes occurred in 8, or 66⅔ per cent.

Cryptorchidism was present in 11 of the 14 patients, pseudocryptorchidism in 4 and true cryptorchidism in 7. In the latter group complete descent of the testes occurred on one or both sides of 3, and partial descent in 2 patients. Two cryptorchids did not respond to treatment.

There was no change in the distribution of fat or weight loss in any of the patients.

It is believed that mares' serum is of definite value in the treatment of certain cases of hypogenitalism and cryptorchidism.

As yet the optimal effective dose has not been established, but the author believes that from 50 to 100 units administered intramuscularly 3 times weekly probably will be more effective than from 10 to 20 units. With the higher dosage, results would probably be obtained in a shorter period of time.

D. E. MURRAY, M.D.

CORRECTION

Birdsall, J. C.: Urinary-Tract Obstruction in Renal Calculus Formation. *J. Urol.*, 1939, 42: 917.

Beginning Line 24, p. 367 of April issue, this abstract should read as follows: In 3 cases in which *partial* nephrectomy was performed for caliectasis, there were no recurrences in periods of five, three and two years, respectively.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC

Baker, L. D., and Shands, A. R., Jr.: Acute Osteomyelitis with Staphylococcemia. *J. Am. M. Ass.*, 1939, 113: 2119.

The authors investigate the clinical results of the use of staphylococcus antitoxin. The antitoxin stimulated by one strain of staphylococcus is capable of neutralizing the toxins of any other strains. The authors believe the toxemia can be estimated by the shift in the ratio of the mature to the immature polymorphonuclear leucocytes found in the blood, since one of the results of the staphylococcus toxin is the destruction of leucocytes. Of the 648 cases of staphylococcic disease reviewed in the preparation of this paper 103 had a definite staphylococcic septicemia; in 65 of these 103 there was an osteomyelitis. Of the 103 patients, 61 died, a mortality rate of 59 per cent. Among the patients not treated with antitoxin the mortality rate was 76 per cent. Likewise in the cases with osteomyelitis the advantage was with the antitoxin treatment as only 25.7 per cent of these so treated terminated fatally; but among those not so treated the mortality was 70 per cent. Among the patients not receiving antitoxin there were only 2 survivors whose blood showed more than 1 colony per cubic centimeter and no survivors whose blood showed more than 10 colonies per cubic centimeter, whereas among the patients receiving antitoxin there were 18 survivors in whose blood there was more than 1 colony per cubic centimeter, and 8 of these showed more than 10 colonies per cubic centimeter.

The routine treatment is as follows:

Sedation is carried out and dehydration is combated with intravenous fluids. The leucocytes are differentiated to estimate the relative percentage of mature and immature polymorphonuclear cells, and antitoxin therapy is used if there is an increase in the percentage of non-segmented and a relative decrease in the percentage of segmented polymorphonuclear cells found in the blood. Transfusions are given frequently. Immediate and adequate drainage is, the authors believe, a prime requisite if the use of the antitoxin is to be effective. The general toxemia of the patient, as evidenced by high temperature, increased pulse rate, respiratory distress, dilated pupils, and sometimes delirium, is considered in outlining the general care but not as an indication for the use of antitoxin. The patient may well be neutralizing the staphylococcus toxin with his own antitoxin, and his apparent toxic condition may be due to other elements. The indication is the shift in white blood cells and the antitoxin is given until the white blood cells show a more favorable ratio between the segmented and unsegmented forms. Free drainage is the operative procedure. At first the authors were inclined to use multiple drill holes, but recently they "window" the bone for better drainage. The part is then immobilized.

HAWTHORNE C. WALLACE, M.D.

Kniewasser, H.: Tumors of the Synovial Membrane—Synovioma (Zur Kenntnis der Geschwuelste der Synovialmembran—Synoviome). Erlangen: Dissertation, 1939.

The so-called synoviomas are tumors which arise from the articular capsule, from the bursal mucosa, or from the tendon sheath. They resemble more or less the structure of the parent organ and frequently exhibit mucous cells, and nearly always exhibit fine interstitial spaces which are lined with endothelial cells and often filled with a serous liquid. According to the age and development, this organ-like structure overgrows quite a large area and consists of a stroma of spindle-like cells which have a decided sarcomatous character. Frequently there are extensions or metastases from such a tumor but they are of a fibrosarcomatous structure without the higher differentiation of the primary tumor. The author groups the reported cases of this type of tumor together and adds 3 individual observations. These tumors generally appear in individuals between the ages of twenty and forty years. The relationship of trauma as a cause does not come into consideration. The end-result is favorable in a few cases, if after removal of the primary tumor a permanent cure has been obtained. In most cases in which the tumor grew slowly, it was completely encapsulated and histologically was very much differentiated and ended in extension and metastases. It is characteristic of this tumor to grow very slowly at first, often scarcely changing size in a year's time, and it has often been treated as joint tuberculosis or rheumatism. Then, at the time of removal of the malignant growth, extensions or metastases are established, mostly in the lungs, which in many cases show an immature structure like that of the primary tumor. On account of the frequent malignant course in spite of a slow beginning, the author recommends a radical operation as the treatment in each case.

(A. BEYER). RICHARD J. BENNETT, JR., M.D.

Abbott, L. C., and Saunders, J. B. deC. M.: Acute Traumatic Dislocation of the Tendon of the Long Head of the Biceps Brachii. *Surgery*, 1939, 6: 817.

Since 1932 the authors have operated on 6 cases of acute traumatic dislocation of the tendon of the long head of the biceps brachii. From their experience they believe that the lesion is not as rare as was formerly supposed.

The authors agree with Meyer that the transverse humeral ligament is too weak to be a factor in holding the tendon of the long head of the biceps brachii

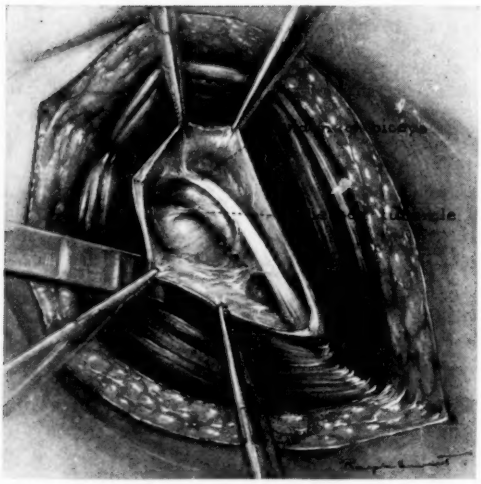


Fig. 1. The tendon of the long head of the biceps brachii is dislocated over the lesser tuberosity of the humerus and the intertubercular groove is almost obliterated.

in its sulcus. They think that the chief structure retaining the tendon within that part of the sulcus which lies between the greater and lesser tubercles is a tendinous expansion from the sternocostal portion of the pectoralis major muscle. Above this, in agreement with Codman, the most important factor in retention of the tendon is the musculotendinous cuff made up of the edges of the supraspinatus and subscapularis tendons which is inserted into the inner side of the intertubercular notch. The varying depth of the sulcus and the presence or absence of a supertubercular ridge are factors which play an important mechanical rôle in the ease with which the tendon may be dislocated.

In internal and neutral positions of the arm, there is no tendency toward displacement, but as external rotation takes place, the tendon is forced against the medial wall of the sulcus. With the arm at the side the tendon approaches a right angle at the uppermost part of the groove. At or about 90 degrees abduction, the tendon is almost straight and parallels the axis of rotation so that in this position there is little tendency for displacement. At 45 degrees of abduction or less the tendon is most easily displaced.

The authors believe that the chief rôle of the long head of the biceps is to guide and redirect the humeral head as it glides on the glenoid during abduction and forward flexion. In their cases, the dislocations were caused by acute trauma and differed in that respect from the cases of Meyer, who believed that the displacement was due to attrition of the joint capsule proximal to its attachment at the lesser tubercle. The outstanding clinical findings in their cases were: (1) swelling of the anterior aspect of the shoulder directly following the accident, (2) tenderness over the region of the long head of the biceps and bicipital groove, and (3) limitation of motion and loss of strength in forward flexion and abduction. Pronation and supination of the forearm against resistance were painful, the pain being referred to the region of the bicipital groove. The outstanding feature, common to all 6 patients, was the "clicking" in the region of the bicipital groove which could be seen and felt on moderate abduction and external rotation of the arm.

At operation in each of the 6 cases the long head of the biceps was found dislocated from its groove and lying medial to the lesser tuberosity (Fig. 1.) when the arm was externally rotated. This displacement could be reduced by medial rotation. In 1 case the tendon of the supraspinatus was partially ruptured at its attachment to the anterior border of the great tuberosity. The operation is done under local anesthesia with the patient in a sitting position.

With dislocation of the tendon one has a choice of division of the tendon from the glenoid with fixation of the tendon to the floor of the bicipital groove, or replacement of the tendon with reconstruction of the roof of the groove to prevent its redislocation. With an associated lesion of the supraspinatus muscle the latter procedure should be used and the muscle should be repaired in order to avoid an unstable shoulder. JOHN O'D. MCCABE, M.D.

Walheim, T.: Tuberculous Spondylitis: A Clinicostatistical Study. *Acta chirurg. Scand.*, 1939, 83: 123.

Two hundred and twenty-one cases of tuberculous spondylitis treated at St. Goran's Hospital, Stockholm, Sweden, between 1913 and 1930, are reviewed. The end-results of the operative cases, numbering 149, are compared with those following conservative treatment. In the conservatively treated cases at the beginning of treatment, the conditions were of longer standing and there was a higher percentage of abscesses and fistulas than in the operative group. From this it may be expected that the final clinical functional results were distinctly better in the cases which were operated upon. In both groups, an attempt was made to correct the deformity by continued pressure on the kyphosis. The author mentions that cases with extensive defects of the vertebral bodies were placed in a separate group and in these no attempt was made to straighten the spine.

Paraplegia was found in 14 patients, and it recurred in 3. Mild short-lived cases were not included in the report, which makes the percentage low. The prodromal symptoms were: a beginning or definite increase in the size of the gibbus; fatigue and increased stiffness of the back; a grinding pain in the back; and, in 1 or 2 cases, girdle pains. Death did not occur as a direct result of the paraplegia in any case. The paralysis disappeared and all of the patients could walk without spasticity. The author

believes that this complication was due to pressure and not to tuberculosis pachymeningitis. In the majority of the cases, inadequate fixation preceded the appearance of the paralysis.

The operative procedure was carried out when the diseased processes appeared clinically and roentgenologically to be at a standstill. During the past two to three years, the affected vertebræ only were fixed by the Albee method with an *os novum* graft. Previous to this, during fusion both above and below the site of the lesion, the grafts had fractured in 20 cases. Following the operative procedure the patients were allowed up at the end of two or three months in order that a compression force would be exerted on the graft and thus cause it to hypertrophy.

Sixty-one patients or 28 per cent had died at the time of this study. This included 24 operatively and 34 conservatively treated patients. In 31 of these, tuberculous spondylitis was the primary cause of death, and in 20, other types of tuberculosis. Relapse occurred in 6 per cent of those treated operatively and 18 per cent of those treated conservatively. In all of the cases, the patients were free from objective and subjective symptoms for two years, and the roentgenogram showed that healing had begun before the recurrence appeared.

The end-result study showed that 82 per cent of the operatively and 73 per cent of the conservatively treated patients are able to do heavy work and take part in sports. In the remainder the most frequent causes of disability are spinal insufficiency, spondylitis deformans, and fracture of the graft.

JOHN O'D. MCCABE, M.D.

Freiberg, J. A.: Low Back Pain. *J. Am. M. Ass.*, 1939, 113: 2195.

The author discusses the difficulty of diagnosis in conditions associated with back pain. Dissimilar lesions are often associated with similar types of muscle-spasm responses. In the lower back there are numerous true joints, and traumatic or infectious processes in these joints will cause muscle spasm. Therefore limitation of the mobility of the lumbosacral joints and restriction in the straight leg test cannot indicate any one lesion. The primary lesion associated with low back pain may be a true joint lesion, synovitis, trauma of the ligament, periostitis, myositis, or a lesion of the intervertebral disk, or, finally, a gradual contracture due to faulty position.

A careful history is important: was there a trauma? have there been previous attacks? was there a first or single site of tenderness? what is the habitual posture? does any position relieve the strain? The acute case will require different handling than the chronic. Acute cases require immobilization most of all. Fractures must be promptly recognized and treated. Protrusions of the intervertebral disk require careful neurological study, lumbar punctures, and possibly visualization studies with iodized oil.

Relief from pain or lying down generally imply that a postural or abnormal mechanical strain has been removed from a lumbosacral or a sacro-iliac joint. Intraspinal lesions such as protruded disks are as a rule unaffected by change of position. Limitation of passive lumbar flexion with the knee extended may be due to lesions of the gluteus maximus and hamstring muscles, lesions of the sciatic nerve, or to articular lesions of the sacro-iliac lumbosacral joints. Yet pain induced on one side only, no matter which leg is tested, centers attention to the sacro-iliac joint on the painful side. When the test is positive during the interval between attacks of back pain, a contracture of the fascia lata or the iliotibial band is indicated. If on passive flexion of the lower leg on the thigh the buttocks arch away from the table and the leg abducts at the hip, there is a contracture of the anterior and lateral thigh fascia. In the supine position with the knee extended, if internal rotation of the leg followed by slight flexion of the hip and adduction of the leg is associated with pain or pressure over the pyriformis muscle there is either a lesion of this muscle or of the sciatic nerve in the region of the muscle. Again with the patient supine, if forcing the flexed hip and knee of one side across the body while fixing the ipsilateral shoulder is associated with pain there is a suggestion of an articular lesion of the lumbosacral or sacro-iliac joint depending on the side of the pain.

One of the most valuable of tests is careful palpatation to determine the area or areas of definite tenderness and if a single site of definite tenderness is found a few cubic centimeters of 1 per cent procaine should be injected. If relief of pain results, the lesion usually involves periosteal or ligamentous tissue.

The paper does not discuss therapy. If a diagnosis can be made the proper treatment is usually obvious.

HAWTHORNE C. WALLACE, M.D.

Steindler, A.: The Interpretation of Sciatic Radiation and the Syndrome of Low Back Pain. *J. Bone & Joint Surg.*, 1940, 22: 28.

The author believes that the great majority of low back strains are due to minor injuries to the soft tissues.

The strain or tearing of tendinous and periosteal attachments of muscles is manifested by distinct and sharply defined pressure points, certain attitudes of relief involuntarily assumed to prevent further strain, and the tendency of the involved structures to respond favorably to immobilization.

The patterns of pressure or "trigger points" in low back pain are divided as follows:

1. The sacrospinalis syndrome producing a pressure point at the posterosuperior or postero-inferior iliac spine.

2. The lumbosacral syndrome, causing a pressure point at the lumbosacral junction.

3. The gluteal syndrome with a pressure point at the insertion of the gluteus maximus.

4. The transversosacral syndrome causing a pressure point at the transversosacral articulation in cases of sacralization of the fifth lumbar vertebra.

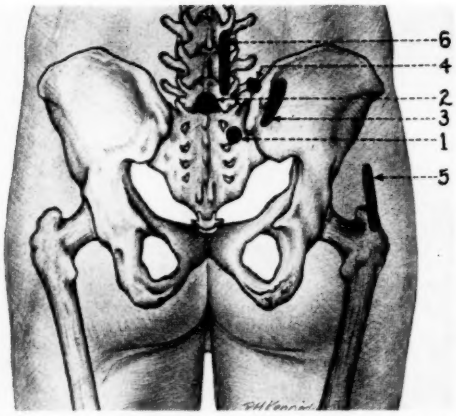


Fig. 1. Grouping of "trigger points." 1, Sacrospinalis syndrome; 2, lumbosacral syndrome; 3, gluteal syndrome; 4, transversosacral syndrome; 5, tensor-fasciæ-latæ syndrome; 6, myofascial syndrome.

5. The tensor-fasciæ-latæ syndrome with the tender point at the lateral border of the fascia and iliotibial band and a positive Ober sign.

6. The myofascial syndrome with vague tenderness of the sacrospinalis muscle and fascial sheath.

Steindler states that, with the exception of one or two clearly defined situations, there is absolutely no anatomical proof that direct nerve pressure is responsible for the sciatic phenomenon. He believes that there is a large group of cases of low back pain in which the sciatic radiation has nothing to do with direct irritation of the nerve trunk or its roots, and that it is a purely reflex phenomenon, which follows and does not precede the low back pain. The afferent branch of the reflex arc is furnished by the sensory fibers supplying the injured muscular, ligamentous, and aponeurotic structures, and the connection with the sciatic nerve is made not lower than the spinal ganglia and possibly the cord. The anatomical argument for this viewpoint is presented, and the therapeutic test of relief following novocaine infiltration of the "trigger point" proves that the sciatic pain is a reflex phenomenon.

Novocaine injection of the trigger point is used as a diagnostic test and is followed by immobilization in a plaster cast, by internal fixation, by resection of a transverse process in a painful transversosacral syndrome, or by relief of tension by an Ober fasciotomy.

DANIEL H. LEVINTHAL, M.D.

Leriche, R.: Sprain and Luxation of the Knee; A Question of Definition and of Treatment (De l'entorse et de la luxation du genou. Question de définition et de thérapeutique). *J. de chir.*, 1939, 54: 593.

Leriche has found that in uncomplicated sprains there is no rupture of a ligament or injury to the bone and the symptoms are due to a vasomotor reaction; sprains may be complicated by injury to either a ligament or bone, but the essential factor is the local circulatory disturbance.

In the examination of a sprain of the ankle, it is the routine at the author's clinic at Strasbourg to infiltrate the ligaments with an anesthetic solution, and make the examination of the joint only when active or passive movements can be carried out without pain. Following this a roentgenographic study is made. The treatment instituted depends upon the findings. If a ligament is ruptured, the leg is immobilized in slight valgus for fifteen days. If there is no rupture of the ligament or injury to the bone, the injured ligaments are infiltrated and the patient is allowed to walk; a second infiltration is done the following day. If the roentgenogram shows that a fragment of bone has been torn away, a small incision is made and the fragment either removed or fixed in place, according to its size. The anesthetic solution employed for infiltration of the ligaments must not contain any admixture of adrenalin; the usual solutions employed for local anesthesia are, therefore, not suitable for the infiltration treatment of sprains. At the Strasbourg clinic, a pure solution (scurocaine, 1:100) has been especially made up and used for this purpose; with this solution a painful reaction very rarely occurs.

What is true of sprains in general applies to sprains of the knee; there may be an uncomplicated sprain of the knee in which there is no lesion of the bone or of the ligaments, and in which the symptoms are due to a vasomotor reaction to injury to the sensitive terminations of the ligaments; this vasomotor reaction produces the local heat, edema, hydrarthrosis, pain, and loss of function that characterizes a sprain of the knee. These symptoms develop without any injury to the ligaments or bone. When this is the case infiltration of the ligaments with an anesthetic solution relieves the pain and permits movement of the joint almost at once and usually results in complete cure within forty-eight hours, as shown by the results obtained in the Strasbourg clinic since 1929. In uncomplicated strain of the knee there may be not only a hydrarthrosis, but also blood in the joint, a hemarthrosis. It is impossible to determine the source of the blood, for in operating on such a joint, the author has found neither a lesion of the bone nor a rupture of any ligament, although he searched for such a lesion. It may be there is merely an exudation of blood, as in ecchymoses; this cannot be proved, but it is a possibility. In operations on complicated sprains of the knee, 12 of which were done immediately after the injury because a bone lesion was suspected and 28 later, some of them for late sequelæ, the author has never found a rupture of the internal lateral ligament—the lesion that is supposed to be of frequent occurrence in severe sprains of the knee. On the other hand, a rupture of one of the cruciate ligaments, or a tearing off of the spine of the tibia were frequently observed, and may be considered the usual type of lesion in severe sprains of the knee.

In luxations of the knee, one bone is displaced in relation to the other bone at the joint. In these cases, the mechanism is different from that of sprain; at the time of the injury the foot and leg are in a fixed position and the body is thrown forward; this results in tearing of the internal lateral ligament and displacement of the femur forward. In such cases the displacement is easily reduced because of the rupture of the ligaments, but early operation is necessary to repair the ligaments and stabilize the joint. Leriche claims, therefore, that a definite distinction must be made between sprains and luxations of the knee joint; the mechanism of the two types of injury is different, and the resulting lesions are different. ALICE M. MEYERS.

Dubois, M.: The Significance of the Pretraumatic Status in Injuries of the Foot (Die Bedeutung des Vorzustandes bei Fussverletzungen). *Ber. 8. internat. Kongr. f. Unfallmed. u. Berufskrankh.*, 1939, 2: 548.

This interesting, concise, and comprehensive report, based on a wide experience on the part of the author, warrants the following conclusions:

When a trauma disturbs an equilibrium in the physical status, which would otherwise have persisted without incident throughout life, the trauma is all that demands practical consideration; constitutional peculiarities of a morphological and functional nature are not to be considered in evaluations under accident insurance in cases in which an accidental trauma has been positively demonstrated. However, diseases exhibiting a progressive character of development may occupy causally so prominent a position that they are to be apportioned medicolegal consideration. In contrast to the lawyer, the medical man is prone to think conditionally, giving weight in the physiology of healing of foot injuries not merely to the injury caused directly by the trauma but to a multiplicity of factors inherent in the injured person. Opinions as to causality will always be divided. In the interest of avoidance of unjust decisions, accident insurance companies must in extreme instances of disease adopt this method of conditional thinking. In diabetes and in the tabetic arthropathies and osteopathies, the morbidic proclivities are so well known that they are given consideration in evaluating results of trauma, since they are known to influence essentially the course of healing. This same may be stated of chronic osteomyelitis, tuberculosis, osteitis deformans, and tumors. Greater difficulties are encountered in insufficiency diseases, in bone cysts which are only partially the result of trauma, focal necroses, and giant-cell granulomas. Sympathetic disturbances are apparently a prerequisite to the development of posttraumatic dystrophies; however too little is known about such conditions. On the other hand, the arthritides and arthroses can be evaluated to a certain extent in accidental injuries. In the widely diffused foot deformities, the condition as a morphological concept without important disturbance of function must be distinguished from the pathological deformity. The former term denotes a morbid potential which must be given notice in the therapy, but not in the computations in the matter of the accident insurance; on the other hand, however, the pathological deformity must in chosen instances be allotted consideration for the period of recovery from the injury and in reckoning the amount of invalidity, especially in cases in which the accidental trauma was a minor one, and the proper treatment had been instituted. Factors consequent to the injury itself must also be carefully distinguished from those foreign thereto in the frequently observed exemplars of contracture of the ankle joints.

In the discussion BOEHLER emphasizes good reposition and sufficiently long-continued and adequate immobilization, and, finally, compatible, active mobilizing exercises, in contradistinction to the formerly widely propagated, so-called functional treatment of all fractures and dislocations.

(HEINEMANN-GRUEDER). JOHN W. BRENNAN, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Abbott, L. C., and Saunders, J. B. deC. M.: The Operative Lengthening of the Tibia and Fibula. *Ann. Surg.*, 1939, 110: 961.

The authors describe in meticulous detail a technique for lengthening of the tibia and fibula based on new principles. Large anatomical drawings and descriptions of the deep fascia, the interosseous membrane, the origin of the muscles, and the points of fixation of the blood vessels, the nerves, and the nutrient vessels; a muscle chart for the various compartments of the leg; and roentgenograms are presented. The principles involve complete division of the deep fascia of the leg, the intermuscular septa, and the interosseous membrane, as well as the freeing of all of the important blood vessels and nerves at the upper portion of the leg. Special osteotomies have been devised, which provide for retention of the maximum portion of the origin of the muscles which pass from the leg to the foot and permit them to travel downward with the descending fragments. Incisions provide for the freeing of the blood vessels and nerves from their points of fixation, and thus permit relaxation of these structures during the lengthening. The operation also provides for the preservation of the nutrient vessels of the tibia and fibula, and with the minimum reflection of the periosteum there is but little disturbance of the blood supply to these bones. The operation is based on sound principles to avoid complications which are certain to occur in some instances with previous methods. The most common complications of leg-lengthening operations are: deformities of the foot such as valgus, equinus, equinovalgus, and calcaneovalgus; deformities of the knee such as genu valgum, flexion contracture, and relaxation of the knee; anterior and medial bowing of the fragments of the tibia with malunion; limitation of motion in the

ankle; weakening of the leg muscles; nerve complications such as paralysis or weakening of the muscles and disturbance of sensation; chronic disturbance of sensation; infection of the operative wound and pin wounds; and aseptic necrosis.

It is emphasized that the operation of leg lengthening is and in all probability always will be a major undertaking with the possibility of serious complications. The procedure demands an intimate knowledge of anatomy, and a careful study of every stage of the operation and postoperative care. It is not an operation for the uninitiated and it should be reserved for those whose experience renders them competent to perform this technically difficult and delicate procedure.

A new apparatus has been developed and described with drawings and comments which the authors believe will lessen the chance of infection in the pin wounds and give better control of the tibial fragments.

Indications for leg lengthening as compared with other methods of equalizing the length of the lower extremities are discussed and 7 case reports are presented with critical postoperative notes.

ROBERT P. MONTGOMERY, M.D.

FRACTURES AND DISLOCATIONS

Cretin, A.: A Contribution to the Study of Hematoma Between the Fragments of Fractures in the Early Stage (Contribution à l'étude de l'hématome interfragmentaire dans les premiers jours de la fracture). *Presse méd.*, Par., 1939, 47: 1495.

Cretin notes that occasionally when a hematoma forms between the fragments of a fracture it is not absorbed; this is an abnormal condition and not frequently observed. As a rule the hematoma is eventually absorbed. In 1 case in which the hematoma was not absorbed by the sixtieth day after the fracture, a bone fragment was removed at operation. Inspection of the site of the fracture showed that there were no osteoblasts present and no regeneration of bone. Small fragments of bone were present in the hematoma; they were not white, but showed yellowish granulations; the interior of these fragments showed the presence of living bone cells. After removal of the hematoma these fragments could be replaced and took part in the formation of the callus. It appeared that they had been preserved by the action of some of the chemical elements of the hematoma.

In most fractures, the blood in the hematoma coagulates and the cells are thus separated from the serum; this process of coagulation takes place more slowly in the area of the fracture than *in vitro*. The serum escapes and is eventually absorbed by the surrounding soft tissues; if the muscles are damaged so that absorption is not completed with normal rapidity, edema results. This, the author believes, explains the edema of the soft tissues so often observed in fractures. The red cells remaining at the site of the fracture are destroyed; and the products of the destruction of these cells and of the disintegration of their hemoglobin affect the new formation of bone. The iron liberated interferes with this formation of bone; the biliary derivatives that are among the end-products of blood destruction also interfere with the new formation of bone, acting especially on the phosphate metabolism. These elements, like the serum, must eventually escape from the site of the fracture and be absorbed by the surrounding soft tissue before callus formation can be completed. The condition of the surrounding soft tissues is, therefore, of importance in the healing of fracture when a hematoma is present at the fracture site.

ALICE M. MEYERS.

Lance, P.: Treatment of Fractures of the Tarsal Scaphoid (Le traitement des fractures du scaphoïde tarsien). *J. de chir.*, 1939, 54: 625.

Lance notes that fractures involving the tarsal scaphoid alone are of rare occurrence; he has seen 6 such cases, in 5 of which the fracture had occurred some time previously; 1 was a recent fracture, while 2 of the 5 old fractures had previously been treated by orthopedic measures but required operation. In cases in which there is no displacement of the fragments, immobilization of the foot in a varus position for three weeks may give satisfactory results. A plaster cast should be employed for immobilization, as this alone ensures keeping the foot in correct position. If there is any displacement of the fragments of the fractured scaphoid, it may be possible to obtain satisfactory replacement of the fragments and reduction of the subluxation of the astragalus, which usually accompanies such fractures, by orthopedic measures; such reduction of the fracture should be followed by immobilization of the foot in a plaster cast. In all the cases reported by the author, there was some displacement of the fragments and in 2 of these cases reduction by closed manipulation had been attempted without success.

Open reduction of a fracture of the tarsal scaphoid with satisfactory replacement of the fragments may be possible, but only when the scaphoid is broken into two equal parts by an anteroposterior fracture. As a rule complete removal of the fragments is necessary (scaphoidectomy) with stabilization of the foot by an arthrodesis. In the recent case in the author's series, a cuneiform arthrodesis of the astragalus was done, but in the older cases a complete mediotarsal arthrodesis with partial resection of the posterior surface of the cuboid. This results in an ankylosed foot, but one in perfect equilibrium.

ALICE M. MEYERS.

Trueta, J.: The Treatment of War Fractures by the Closed Method. *Brit. M. J.*, 1939, 2: 1073.

The material on which this article is based consists of a series of 1,073 cases treated by the author at the General Hospital of Satalunya, Barcelona. His experience has led him to believe that early and adequate débridement of the wound offers the best hope

for the prevention of infection. Antiseptics and serums are of doubtful value and the use of sulfanilamide has not been very effective.

The author describes two types of shock. The primary or psychic shock occurs immediately after infliction of the wound and responds rapidly to morphine, lobeline, heat, and blood transfusion, together with physical and psychological rest. To this primary shock is added secondary or true shock when the wound has not been properly treated within a few hours; this results from the absorption of disintegrating tissues, and can be avoided by operation on the wound within two hours after its infliction.

The best method of treatment, in the author's opinion, is the establishment of adequate drainage with sterile absorbent gauze introduced between the tissues in the direction of the muscle fibers. This is to be followed by rigorous immobilization, preferably in plaster, without disturbance of the wound for dressings. Unpadded casts are used and no windows are employed. In only 8 of 1,073 patients did the cast have to be removed for cellulitis or lymphangitis. Only 1 case of gas gangrene occurred in the author's series.

At the end of the war, thousands of wounded made their way into France wearing their casts. Although they were exposed to such handicaps as fatigue, hunger, and demoralization, the incidence of serious infection remained extremely low.

DANIEL H. LEVINTHAL, M.D.

Soulié, J., and Linares, C.: The Closed Method in the Treatment of War Fractures (La cure occlusive dans le traitement des fractures de guerre). *J. de chir.*, 1940, 55: 22.

The authors report their experience in the treatment of war fractures by the closed method in 389 cases. In the majority of cases the fractures were compound with extensive wounds and fracture-osteomyelitis justifying amputation. In some instances suppuration had been present for several months. In these cases the delayed closed method was employed; it consisted of débridement, saucerization of the wound, extraction of the foreign body and bone splinters, and the application of a plaster-of-Paris cast directly against the wound and skin without the interposition of dressing to the wound or cotton batting and without fenestration. The fracture was always reduced before the application of the cast.

A brief historical review of this method of therapy is presented and its rationale discussed. The indications for the early and delayed forms of treatment are considered. The indications for early closed treatment are the same as those for the primary suture of wounds, i.e., it must be possible to perform the procedure within six hours after the injury, and to extirpate all devitalized tissue with absolute certainty. This is usually possible in compound fractures of civil practice. However, in compound war fractures the delayed closed treatment is usually indicated. The authors have used the delayed closed treatment in cases of compound fractures with infected wounds and considerable devitalization of the soft parts, and with fracture osteomyelitis. In another group of cases the authors have used Orr's treatment to allow the filling-up of large cavities which resulted from the injuries by shrapnel, or to allow the extraction of sequestra.

This method of therapy is contraindicated: (1) in the presence of a vascular lesion; (2) when gas gangrene is suspected; (3) in the case in which it is not certain that all devitalized tissue has been completely excised; and (4) in the case in which simple débridement has been done or effective intervention must be delayed. Reduction of the fracture is imperative before the application of the closed treatment.

The technique of this method of therapy is described. Anesthesia consists of brachial-plexus block for the upper extremities and spinal anesthesia for the lower extremities. The skin is prepared by careful cleansing with soap and water followed by painting with tincture of iodine. All damaged tissue is meticulously excised. Considerable emphasis is placed upon the importance of removing contused and devitalized muscle tissue. Bone splinters far removed from the site of the fracture as well as all foreign bodies are extracted. The wound is completely saucerized. Absolute hemostasis is done with fine catgut. In wounds of civil practice treated within six hours after the injury, primary suture is employed. However, in war injuries primary closure is not used. Reduction of the fracture is always secured at the time of operation. For fractures of the upper extremities Boehler's method of traction is employed and for the lower extremities some form of orthopedic table is used. Reduction should be done under roentgenoscopic control. The plaster-of-Paris cast is then immediately applied while the patient is still on the operating table. The plaster is applied directly to the wound and skin without the interposition of stockinet, dressings, or cotton-wool. Windows should never be placed in the plaster cast.

The authors report a total of 389 cases treated by this method with no deaths and no amputations. Good results were obtained in 332 (85.34 per cent), fair in 40 (10.28 per cent), and poor in 17 (4.37 per cent). Of the 389 patients, 218 had injury to the soft parts, 93 had moderate fractures, and 78 had severe fractures. In the first group the results were good in 206, fair in 9, and poor in 3; in the second group, they were good in 71, fair in 14, and poor in 8; and in the last group, they were good in 55, fair in 17, and poor in 6. MICHAEL DEBAKEY, M.D.

Kini, M. G.: Dislocation of the Elbow and Its Complications: A Simple Technique for Excision of the Elbow. *J. Bone & Joint Surg.*, 1940, 22: 107.

Among the 330 cases of elbow injury admitted to the King George Hospital, there were 38 dislocations and 1 ankylosis due to smallpox; the latter case is

included as the treatment was the same as that employed in cases of unreduced dislocations. The average period which elapsed between the injury and admission to the hospital was two months. Three of the cases of dislocation are not included in this report, as the postoperative interval has not been long enough to permit an accurate estimation of the results. A tabulated analysis of 36 cases of elbow injury is shown with the results at the time of discharge and at follow-up in 1938.

The treatment of elbow dislocation when the patient is seen immediately after the accident is simple provided roentgenographic examination before reduction and preliminary investigation for nerve injuries are made. Reduction of the dislocation under anesthesia and a roentgenographic examination after the reduction, followed by proper splinting, enforcement of sufficient rest, and the institution of graduated active exercise with physical therapy after removal of the splints to restore function are then in order.

The most common complications in this series were nerve injuries in 2 cases, myositis ossificans in 14 cases, and unreduced dislocation resulting in fixation of the elbow without new bone formation and with marked deformity, 12 cases.

The author believes the simplest means of operative intervention to restore the movement of the elbow is a properly designed excision, which gives the same satisfactory results as arthroplasty, and he has used the following technique with success:

Through Langenbeck's incision, sufficient bone from the lower end of the humerus and the upper end of the ulna is excised to produce a gap measuring at least 1½ in. The bones are shaped to resemble the normal articulate ends and are smoothed with a file. Skeletal traction from the lower end of the radius and of the ulna is obtained by a Kirschner wire. A firm bandage is then applied to the elbow to prevent effusion, and the limb is put in extension in a Thomas arm splint for 2 weeks. At the end of a week, the stitches are removed without disturbance of the traction, and at the end of another week the Kirschner wire is removed and active flexion with slight support is encouraged. On the first day, active flexion to 160 degrees is usually obtained. To prevent effusion as a result of this movement, the elbow is supported in a plaster-of-Paris cast. This method of active flexion is repeated from day to day until flexion of from 45 to 50 degrees is obtained. When this stage has been reached, active movements with physical therapy are started to restore the normal functions of the muscles controlling the elbow joint. The elbow is always rested in flexion with a collar-and-cuff splint. In about two months' time the patient's ability to flex and extend the elbow against resistance is easily restored, and the patient is discharged to carry on the treatment at home.

To evaluate the success of this treatment, it is necessary to test the results for the cosmetic effect and the weight-lifting capacity. Tests for function should also be made. Of the 9 patients treated by the technique described, all but 1 were found to have normal functioning elbows.

EMIL C. ROBITSHEK, M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Conner, L. A.: Thrombophlebitis and Its Pulmonary Complications. *New England J. Med.*, 1940, 222: 125.

The author assumes that the terms, "thrombophlebitis" and "venous thrombosis" may be used interchangeably. He describes the structure and mode of formation of such thrombi. The platelet thrombus is the primary thrombus. It is firmly cemented to the vein wall by the process of agglutination, whereas the friable red secondary thrombus has little or no such attachment. In most cases, there may be continued propagation of the thrombus centrally by repeated deposits of masses of agglutinated platelets, with intervening areas of red clot. These propagated red clots are believed to be the source of most of the fatal pulmonary emboli.

Of the various causes of thrombosis, the author dwells on the variations in blood flow, changes in the composition of the blood, and changes in the vein wall. Local disturbances of the blood flow in the veins themselves are more important factors than the general slowing of the blood current. Dehydration is the one change in the composition of the blood which is most likely to be significant and most easily understood. No relation between an increase in platelets and the tendency to thrombosis has ever been found. Changes in the vein wall from trauma or infection are of paramount importance among the factors leading to thrombosis.

In a daily routine examination of the legs of patients with typhoid fever, the author found that the thrombotic process began somewhere below the knee. Most frequently the first signs appeared deep in one or both calves, with pain or soreness on stretching of the calf muscles. Much less frequently the signs first appeared in the foot with tenderness and, perhaps, induration about the heel or deep in the sole. The thrombotic process was confined almost exclusively to the deep veins of the leg. The progress of the clinical signs of most of these thromboses was upward, until a typical phlegmasia alba dolens occurred.

Frank signs of femoral thrombophlebitis varied greatly in time of appearance after the initial symptoms. They appeared in two or three days or as late as three or four weeks. Twenty patients having typhoid fever, who were seen by the author, had obscure, multiple chills as complications or sequelæ to the typhoid fever. Such abrupt rises of temperature with rigors occurred almost daily for two or three weeks without obvious cause. In 16 of these cases there were well marked signs of thrombophlebitis. The significance of these multiple chills is unknown but that they had some relation to the venous thrombosis is beyond question.

The obscure condition of painful and exquisitely tender toes is an occasional complication of typhoid fever, and appears late in the disease or during convalescence. In 12 of 22 patients having this complication, there was also thrombophlebitis of the legs. These facts are suggestive of a connection between thrombosis involving the legs and the symptom of tender toes. In the opinion of the author, the careful daily examination of patients after operation might occasionally reveal evidence of early thrombosis in the calves or feet some days before a femoral thrombosis declares itself by the occurrence of a fatal pulmonary embolism.

For prevention, the author believes that elevation of the foot of the bed to hasten venous return from the legs, the avoidance of everything that increases intra-abdominal pressure, the stimulation of active diaphragmatic breathing movements, and the replacement of losses of body fluids are all measures which deserve to be employed. The use of heparin is capable, in experimental animals, of preventing the formation of the platelet thrombi. Its value as a routine measure in postoperative cases can be determined only by further experience.

HERBERT F. THURSTON, M.D.

DeTakáts, G., and Reynolds, J. T.: Amputation for Peripheral Vascular Disease. *Arch. Surg.*, 1940, 40: 253.

In spite of significant additions to the conservative therapy of peripheral vascular disease, such as suction and pressure therapy, intermittent venous hyperemia, iontophoresis with acetylbetamethylcholine hydrochloride, and other measures, there still remains a group of cases in which amputation must be performed either as a life-saving measure or to rid the patient of a painful and functionless limb which undermines his morale and lowers his earning capacity. It has seemed to us that since the advent of the newer conservative measures, which are urged and demanded by patients even in obviously hopeless cases, patients come later than ever for amputation, and thereby increase the mortality and discredit the procedure.

It is well first to give the patient a "fair chance to save the limb" and by this is meant the following conditions must exist: (1) ability of the patient to have absolute rest in bed and adequate nursing care for approximately three months; (2) absence of any sign of spreading infection (which would indicate immediate amputation); (3) absence of massive gangrene (small gangrenous patches or true cutaneous infarcts may slowly fall off and epithelize), and (4) absence of intractable pain, or good response to absolute rest, proper postural angle, vasodilators, mild sedatives, passive vascular exercises, or paravertebral block with alcohol. When these conditions are not fulfilled, an early amputation lowers the mortal-

ity, restores the patient's morale, and may restore some of his earning capacity.

Two tests have been used by the authors to ascertain the proper level of amputation: (1) the determination of the cutaneous temperatures, and (2) the production of histamine flares. On the basis of several hundred determinations, they have concluded that a positive reaction to histamine insures a viable skin flap, provided no severe infection or undue tension of the skin sutures occurs. It is emphasized that the patient should be prepared generally for the amputation and also that if one is to do the procedure without infection, the local region must be prepared properly.

The methods of amputation vary with the type of lesion for which the amputation is being done. Four types of amputation have been done in cases of peripheral vascular disease, namely: metatarsal amputation, amputation of the lower part of the leg, transcondylar amputation, and supracondylar amputation. Amputation high up on the thigh was necessary in a few cases of embolic obstruction of the common iliac artery. The authors cite a few cases in which the different operative procedures were indicated. It should be remembered that the mortality rate can be reduced markedly by amputation before infection is superimposed on gangrene.

PAUL MERRELL, M.D.

BLOOD; TRANSFUSION

Snapper, I., Liu, S. H., Chung, H. L., and Yü, T. F.: Anemia from Blood Donation: A Hematological and Clinical Study of 101 Professional Donors. *Chinese M. J.*, 1939, 56: 403.

A group of 101 Chinese blood donors were studied after the donation of from 1 to 25 liters of blood over a period of from two months to ten years. The average rate of bloodletting was from 200 to 400 c.cm. per month. An anemia of variable degree was found in 75 per cent of these donors, most severe in those giving the largest quantities of blood. Forty-four per cent of these donors had a hemoglobin of 10 gm. or less. Studies of the rate of regeneration of hemoglobin showed a much slower recovery than could be expected from reports in Western literature. Six cases were hospitalized and carefully studied. The anemia was found to be of the microcytic hypochromic type.

Two important factors were mentioned as probable causes of this failure of blood regeneration, which is almost unknown in donors in Europe and America. The donors averaged about 53 kgm. in weight and thus were giving a relatively larger quantity of blood than American donors. The other and probably more important consideration was the diet of the donors. The average monthly income of these donors was $15.90 and from previously published data it was calculated that the diet of this class of Chinese contains only enough iron to maintain the normal hemoglobin level in the absence of any unusual blood loss.

The majority of these cases responded rapidly to large doses of iron, but not so uniformly or rapidly to cessation of the blood loss.

Besides the anemia there were other almost constant findings in the blood of leucopenia, lymphocytosis, and eosinophilia. Clinically, glossitis, splenomegaly, and achlorhydria were frequently noted. All of these conditions improved or disappeared if the nutritional status of the patient was raised after the cessation of blood loss for from one to two months.

THOMAS C. DOUGLASS, M.D.

Papa, A.: Renal Complications in the Transfusion of Compatible Blood (Complicanze renali da trasfusione di sangue compatibile). *Ann. ital. di chir.*, 1939, 18: 807.

The author gives due credit to Landsteiner, Jansky, and Mosso for establishing a scientific basis for modern blood transfusion. He mentions Kordenat and Smithies' classification of post-transfusion reactions: immediate hemolytic reactions (hemoglobinuria, purpura); anaphylactic reactions (protein shock with leucopenia but no hemolysis); and constitutional reactions with fever but without other abnormal symptoms. The author cites cases of post-transfusion reactions from the literature. He mentions among others the report of Hesse and Filatow who noted a death after transfusion with compatible blood although previous transfusions had been uneventful. Johnson and Conway have reported 3 cases of renal insufficiency after transfusion; 1 patient had had 4 transfusions previously.

The author has studied urinary function after transfusion with citrated blood in clinical cases and experimentally in rabbits. He also studied the kidneys histologically, whenever possible. He found in control experiments that the citrate in saline without blood was absolutely innocuous. One patient with carcinoma of the hepatic flexure of the colon received 250 c.cm. of citrated blood and went into shock one hour later; he died of anuria.

The author has shown by his clinical and experimental studies that in all cases of transfusion there are varying degrees of renal disturbance, from the most minor to fatal reactions. These reactions are more serious in repeated transfusions, in which the reactions may become more and more severe and finally terminate in anuria and uremia. Experimental studies have indicated that the liver is also injured. Hesse and Filatow explain immediate reactions by "renal block" due to a spasm of the renal artery and accompanied by a fall in the blood pressure. The author demonstrated renal and hepatic changes in his histological studies on transfused rabbits.

JACOB E. KLEIN, M.D.

LYMPH GLANDS AND LYMPHATIC VESSELS

Homans, J.: Lymphedema of the Limbs. *Arch. Surg.*, 1940, 40: 232.

An attempt has been made by the author to sort out and describe the lymphedemas, especially those

of the lower limbs, which are known to be due to local causes. Three principal groups are readily recognizable:

1. A group of edemas associated with disuse and injury and due primarily to failure of the lymphatics to dispose of tissue fluids normally produced.

2. Edemas associated with venous obstruction and due primarily to failure of the lymphatics to dispose of an excess of tissue fluids forced on them by elevated venous pressure.

3. Edemas due to a natural or acquired deficiency of the lymphatics themselves, that is, elephantiasis.

4. Reflex, or trophic, edemas, related to countless causes and including the causalgia-like states.

5. Allergic edemas, caused by hypersensitiveness to foreign substances, especially the fungi of the skin.

6. Cavernous lymphangiomas.

Lymphedemas or swellings, peculiar to the limbs, are considered in this report under the following headings: (1) edemas directly due to disuse and injury; (2) edemas due to venous thromboses; (3) elephantiasis; (4) reflex edemas; (5) allergic edemas; and (6) cavernous lymphangiomas.

In conclusion, the author notes that the elephantiases, that is, those associated with a total disappearance of the lymph vessels, are unexplainable and are really incurable; that is to say, there is no way of restoring drainage of the tissue fluids. To do away with the swelling, one must remove the tissue in which the fluid collects. This need not be done for the thigh; it is enough to reduce the size of the leg below the knee.

None of the other lymphedemas is wholly of lymphatic origin. That which originates in femoro-iliac thrombophlebitis is certainly due in part to involvement of the larger lymph vessels of the pelvic brim in the perivascular exudation which is so often present in these cases, but venous obstruction and peripheral vasospasm certainly contribute to the swelling of the limb.

The allergic edemas are undoubtedly going to prove of increasing clinical importance. As yet it is not known whether such states can become established without definite acute attacks of redness, swelling, and fever. If edemas of this sort can arise quietly, then the various fungi of the skin must be even more common and have more access to the internal mechanism than is now believed to be the case.

The reflex edemas, that is, the rare and picturesque swellings which arise unpredictably from trivial injuries and infections, seem to be related to sympathetic control of the peripheral blood vessels. However, their peculiar mode of origin, especially in trauma to certain nerves (the median and sciatic) should make one careful not to be too certain of their nature, and the hypersensitiveness to touch which is so often associated with them appears to give them a relation to the causalgias. There is much to be learned of the relation of pain, superficial tenderness, and edema, as a syndrome, to the somatic and sympathetic nervous systems. The reflex pathways concerned with the reflex edemas and causalgia-like states require especial study.

HERBERT F. THURSTON, M.D.

SURGICAL TECHNIQUE

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

Elkinton, J. R., Gilmour, M. T., and Wolff, W. A.: The Control of Water and Electrolyte Balance in Surgical Patients. *Ann. Surg.*, 1939, 110: 1050.

This report describes a routine developed at the Pennsylvania Hospital for the control of electrolyte and water balance in patients undergoing serious surgical procedures. Emphasis is placed on the simultaneous determination of the hematocrit values, plasma protein, and total base as giving a fairly accurate picture of the state of hydration and electrolyte balance.

The essential problem in estimating the degree of hydration is the determination of the extracellular volume of water. Practically, aside from clinical signs, the extracellular water volume can be approximated only by considering indirect evidence obtained from its intravascular portion, the plasma. One of the simplest clues to plasma volume is the hematocrit, which measures the relative proportion of plasma to erythrocytes. In the absence of progressive changes in the total number of erythrocytes, such as with hemorrhage or with transfusion, serial hematocrit values reflect changes in the plasma volume. Likewise, changes in plasma-protein concentration, when there is no addition or loss of protein may reflect changes in the volume of the plasma.

The actual amount of water held in the extracellular reservoir is dependent on the amount of total base (mostly sodium) present. The electrolyte concentrations of the intracellular and extracellular body fluids are maintained at a remarkably constant level. Loss of electrolytes with a parallel loss of water from the extracellular fluid compartment does not produce changes in electrolyte concentrations. Only when the extracellular reservoir of base and water is seriously depleted is there a fall in the total base concentration in the plasma. The total base concentration itself, however, gives no indication as to the total amount of base and water that has been lost.

Not only the total base concentration but the relative proportion of acidic and basic constituents is important in a patient with an abnormal loss of fluid containing electrolytes. Such loss of fluid may result in acidosis or alkalosis, in addition to dehydration. Determination of plasma carbon-dioxide combining power and plasma chlorides, from which the total base concentration may be approximated, is important in following the patient's base concentration.

The importance of an adequate intake of carbohydrates and vitamins is well known. The protein metabolism in surgical patients is also of some importance. Definite levels of plasma proteins are necessary in order to maintain the osmotic pressure of the plasma.

The combination of repeated simultaneous hematocrit, plasma-protein, carbon-dioxide combining power, and chloride determinations gives valuable information for controlling certain types of patients. The degree of hydration in such cases may be estimated from these four main values, considered together with clinical signs. This is especially helpful when the patient is first seen in a dehydrated state and the previous daily total fluid intake and output are not known. When the patient is under observation the daily total fluid balance, intake and output, is followed, water loss from vaporization being estimated. The volume and specific gravity of urine are also valuable indices. In the authors' study, however, the combination proposed above has seemed to give a more reliable indication of the fluid balance in the patient, as well as indicate the erythrocyte and plasma-protein levels.

The authors stress the simplicity of making these determinations routinely, and they describe the methods used.

The routine described gives very definite indications as to the type of fluid need. A low or falling hematocrit value usually indicates the need for whole-blood transfusions. A low protein concentration is a prime indication for plasma transfusion when the hematocrit value is normal or above normal (as in burns); protein is supplied while at the same time blood cells are not added to a vascular system already relatively overloaded with them.

Parenteral fluids are given to a great majority of patients according to relatively simple rules. Normal saline solution (usually containing 5 per cent glucose) is given in equal volumes to replace losses of abnormal fluids (gastric, biliary, pancreatic, intestinal) which never exceed physiological saline concentration, plus an allowance of from 1 to 5 gm. of sodium chloride for urinary excretion. The balance of water for insensible loss, estimated to lie between 1 and 2 liters, is given as a solution of 5 per cent glucose in distilled water.

Several methods for the estimation of electrolyte need in the patient with a serious water and electrolyte depletion are discussed. One easy method is to replace abnormal fluid losses with equal volumes of normal saline solution. In cases with marked acidosis, the quantitative use of sodium lactate to raise the carbon-dioxide combining power is proposed, according to the suggestion of Hartmann. The authors present a formula which they have worked out for the calculation of the amount of electrolyte required.

The use of the values—hematocrit, plasma-protein, and total base estimated from chloride and bicarbonate—is illustrated in 10 appended cases.

SAMUEL H. KLEIN, M.D.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Haldbo, H.: Nutritional Disturbances of the Limbs Following Accidental Injuries (Ernaehrungsstoerungen der Gliedmassen nach Unfaellen). *Nord. Med.*, 1939, p. 2053.

Following comparatively mild trauma of the extremities one occasionally observes the development of very serious conditions accompanied by pain, severe functional disturbances, bone and joint changes, and, furthermore, by vasomotor and sweat-gland disturbances as well as trophic changes of the skin and nails. In this group of variegated post-traumatic diseases, we are dealing with a uniform clinical syndrome. The nutritional disturbances of the extremities probably have their origin primarily in an injurious disturbance of the functions of the sympathetic nervous system. One finds these nutritional disturbances most frequently in older people, over the age of fifty, but never in children. The clinical picture presents considerable variations, both between the different cases, and during the various stages of the disease in one and the same case. In spite of numerous transitory forms, one always finds pain, bone changes, and functional disturbance of the sympathetic nervous system. In the less severe cases these changes may disappear completely and the bones again take on their normal appearance. In other cases the disease progresses steadily so that it may go on to a fully developed dystrophy; thus, the hands show cyanosis, smooth skin, and stiff, tapered fingers which are no longer able to perform any function.

As a general basic form of therapy the application of plaster casts may be recommended, but as far as possible there should be intensive movement of the extremities. Should the disease progress in spite of this, then a sympathectomy should be undertaken, with which considerable subjective and objective improvement may be accomplished. In the earlier stages a similar improvement can sometimes be obtained by the repeated injection of novocaine. As to the pathogenesis of the post-traumatic dystrophies of the extremities, the development of a sympathetic insufficiency with diminished vasoconstrictor tonus, as well as of areas of increased or decreased sweat secretion in the affected limbs, is today regarded as the most important explanation.

(Haagen). Harry A. Salzmann, M.D.

Glaspel, C. J.: The Management of Traumatic Wounds. *J.-Lancet*, 1939, 59: 521.

Considerable evidence has accumulated to prove that common and simple traumatic injuries do not receive the scientific treatment which they merit.

The basic surgical principles which should apply to traumatic wounds are: (1) the control of hemorrhage and shock; (2) careful examination of both the wound and the patient; (3) sterilization and closure of the wound; and (4) placing the tissues at rest, plus restoration of function.

Even though much experimental research has been devoted to shock, this syndrome is not understood in detail. However, the following general facts are accepted: namely, patients in shock should not be subjected to general anesthesia or any surgery; the best method of combating shock, in addition to the use of morphine, external heat, and the horizontal position, is the administration of fluids per vein. Blood is the fluid of choice, with acacia and glucose next in value; adrenalin and cardiac stimulants are of questionable value and may even be contraindicated. It is difficult to estimate the part which the fear complex plays in the production of shock; however, it is advisable to reassure the patient that all is well.

Careful examination of the patient is necessary in order to discover concealed injuries. Patients in shock or under the influence of either alcohol or morphine do not localize their pain accurately, and it is easy to overlook internal injuries and even fractures at the primary examination. Failure to recognize the presence of serious injury at the original examination may result in delay in the institution of proper treatment.

No wound can be considered surgically clean. Soap and water are excellent cleansing agents for wounds, when properly used, but some form of anesthesia is desirable to eliminate the pain resulting from the cleansing process. The margins of the wound should be gently retracted and the deeper portions thoroughly cleansed. Many alcoholic antiseptics are irritating and actually harmful to living tissue cells and there is no proof that these are more efficient than an aqueous solution of mercuric chloride.

Débridement is a sound surgical procedure, but living tissue should not be needlessly sacrificed. Wounds should be carefully closed with a minimum of suture material. Catgut produces a distinct tissue reaction and, when employed, should be used in extremely small sizes. There is a distinct tendency at present to use more fine silk and less catgut in wounds, unless they are grossly contaminated and require drainage. Divided nerves and tendons must be sutured with meticulous care.

In infected wounds, warm moist dressings are the treatment of choice, but the dressings must be kept warm, since cold lowers tissue vitality. Infected wounds must be treated with extreme gentleness and the treatment must be especially conservative in infections of the upper lip, nose, and face.

The prophylactic use of anti-tetanic and gas-bacillus serum should never be omitted, and its use is especially indicated in wounds contaminated by manure. Sulfanilamide is of questionable value in gas-bacillus infections, but evidence is accumulating to prove the value of x-ray therapy, both as a prophylactic and as a curative measure.

Rest is a therapeutic agent of great value, and splints should be used in other conditions than fractures. Gentle active motion should be employed as soon as it is possible to do so without causing pain.

Other forms of physiotherapy have their value, but they are of most help in cases in which earlier treatment has been scientifically accurate.

Basset, A.: Emergency Treatment of Deep Injuries of the Joints (A propos du traitement d'urgence des plaies pénétrantes des articulations). *Presse méd.*, Par., 1939, 47: 1493.

The author delivered two lectures at the Académie de Chirurgie, Paris, on November 30, and December 21, 1938, on emergency treatment of deep injuries to the knee-joint with osseous lesions. The treatment consisted of patellectomy and suture without drainage (Mialaret) in 1 case, and of cleansing the wound, capillary drainage, and flat dressing without suture (Querneau) in 2 other cases.

These reports were followed by a discussion covering emergency treatment of deep injuries to the joints as well as the treatment of all accidental injuries to the extremity.

The author prefers patellectomy followed by suture without drainage whenever possible; this statement, however, gave rise to a divergence of opinions, particularly regarding the use of primary suture in cases of deep injury to the joint. Opponents of the primary suture in cases of deep injury to the joint declare that closure without drainage of the joint cavity opened accidentally is dangerous, because we have no biological or other criterion to assure us that acute arthritis will not follow after closure of the joint injury (Sorrel). Desplas, who is even more opposed to primary suture, has reported to the Academy that in 13 cases of serious accidents he had been called upon to intervene after other surgeons had performed primary sutures with unfavorable results.

However, the author points out that 6 of these cases mentioned by Desplas did not constitute joint injuries; in 1 immediate amputation was done, and in another opening of the joint was doubtful. Desplas considers injuries encountered in civilian practice more serious than war injuries, for they are usually due to crushing and cause serious trauma to the tissues involved, vascular and nervous lesions, and trophic torpor of the injured region. Thus Desplas refrains from suturing in positive cases as well as in doubtful ones.

On the other hand there are certain surgeons, among them Duval, Mathieu, Picot, and the author, who favor a primary suture and declare that from the point of view of treatment there is no difference between war injuries and injuries encountered in civilian life.

Mialaret and Leclere, likewise, have observed excellent functional results after thorough cleansing of the injured tissues and joint cavity, treatment of the osseous lesions, and immediate and complete closure of the synovial space, with or without primary suture of the superficial region. Ameline, in fourteen years of civilian practice, has treated 7 cases of joint injury with primary suture and in all his cases has obtained excellent results without complications. Rouhier, Gaudier, and De Fourmestraux also prefer primary suture to other methods in all cases in which lesions permit its use and in which success is assured. In a case reported by the author complete success followed excision of a large cutaneous, aponeurotic wound, fixation of the fractured patella, and total primary suture of the synovial and superficial region.

Querneau has furnished a report of 2 other recent cases. Intervention took place two or three hours after the accident, and consisted of excision of the separated tissues, cleansing of the joint cavity, and light suturing of the surface. Both cases were followed by complete recovery. The author states that in 3 of 5 cases cited by Desplas, in which surgical intervention was necessary after primary suture, the suture had been made without previous excision of any kind, and without cleansing of the wound; in fact, the wound had been treated like an aseptic surgical incision. One of these cases (fracture of the patella) resulted in serious infection two days later, necessitating renewed intervention, namely, enlargement of the wound and excision of its margin. This careless treatment of joint injuries is most deplorable, for primary suture was performed in these cases without considering the necessity of resection of the cutaneous wound margins, excision of infiltrated tissues, exploration of lesions, treatment of osseous lesions, if such were present, and thorough cleansing and drying of the joint cavity.

The author enumerates a number of rules to be observed in the emergency treatment of joint injuries.

The injured person should be placed in the hands of a competent surgeon as soon as possible; he should be hospitalized in order to receive adequate pre-operative examination, operative treatment, and postoperative care. If skeletal lesions are suspected, roentgenological examination is indicated, and should be followed immediately by surgical intervention under general anesthesia. Local or spinal anesthesia limits the operative field and should be avoided.

The first stage of the operation is directed toward the cutaneous injury. Clean incised wounds may be sufficiently enlarged to allow exploration. In case of contusion, resection of the skin margin is indicated before deep exploration is attempted. It is impossible to give exact rules regarding the extent of this resection. When the cutaneous wound does not lead directly to the joint, it is advisable first to suture the cutaneous wound (taking the necessary precautions), and to follow this by a new incision in order to open the joint at a point permitting a complete examination. This incision must be sufficiently large for the detection of deep lesions. Adequate but not excessive resection of all bruised, lacerated, and torn tissues, and evacuation of hematomas are important procedures.

When the synovial space has been opened, the interior of the joint cavity is carefully examined and all accumulation of blood is removed. It is evident that all soft tissues as well as the joint itself

must be carefully examined for possible foreign bodies, such as missiles, fragments of metal or clothing, thorns, or splinters of glass or wood. After the joint cavity has been opened, the number of osseous lesions is recorded. Their treatment depends upon the seriousness of the injury. When the lesions involve merely the non-articulate portion of the bone, treatment should be conservative. After ablation of the small loose fragments and curettage of the spaces, fixation and replacement of the osseous fragments are carried out. If, on the other hand, the injury to the bone is too great to allow reparation, the course taken by the surgeon must be entirely different and must be directed, for example, toward resection of the fractured patella, or either typical or atypical uni-osseous or bi-osseous resection.

The next step is the protection of the synovial spaces and the articular extremities against infection, and each case will suggest its own and best method. If all necessary precautions have been taken, and if surgical intervention has been possible within from eight to ten hours after the accident, the author firmly believes that suture, at least capsulosynovial suture, without drainage is in order; it affords the best means of safe-guarding articulation and avoids secondary infection.

In muscles, the aponeurotic region, and in the skin, suture may be partial or may be omitted entirely if contusion has made severe resection, with consequent prevention of approximation of the wound margins, necessary. On the other hand, if the loss of tissue is serious, and osseous lesions have necessitated typical or atypical resection, and if intervention has been delayed so that local infection and hyperthermia have set in, the author is of the opinion that primary suture would be a serious mistake and that ample and complete drainage of the joint cavity and the adjacent tissues is essential.

Postoperative treatment includes a careful check-up of the temperature curve, condition of the suture, and articulation. If fluid has accumulated, as is not infrequently the case in injuries of the knee, puncture must be performed and the liquid drained must be subjected to bacteriological analysis. The application of a plaster cast after the operation depends upon the individual case. An injury of the joint without osseous lesion, or an injury of the knee with only a patellar lesion does not require a cast, and a compression bandage assures sufficient immobilization. However, lesions of the articular extremities of the long bones render immobilization with a cast desirable even when they do not require bone resection. HILDA H. WULLEN.

Sereghy, E.: Anaerobic Infections in Injury of the Extremities (Anaerobe Infektionen bei Extremitaetenverletzung). *Honvédorvos*, 1939, 11: 98.

Spore-forming pathogenic anaerobic bacteria occur normally in association with the other non-pathogenetic bacteria in human and animal intestines. All things which come in contact with the intestinal contents directly or indirectly, must be considered as being infected. In various tests of the soil, the gas bacillus was found in 100 per cent, and the tetanus bacillus in 64 per cent of the cases. The contamination of the soil with animal and human excreta increases the virulence. The hair, the clothing of soldiers, and missiles are the best carriers of infection. Gunshot injuries should always be considered as infected. The reduced power of resistance, emaciation, collapse, unfavorable conditions of transportation, damp weather, local anemia, small gunshot wounds of entry, extensive destruction in the muscles of the extremities, the injury of large blood vessels, extensive extravasations of blood, contamination of the wound with soil, pieces of clothing, and retained pieces of shot, and anaerobic conditions favor the development of infection.

Gas phlegmons occur in the form of malignant emphysema and of marked malignant edema. In both, either toxic manifestation or local inflammation is the chief symptom. The mixed form is the most common. Gas gangrene and malignant edema may occur together clinically; the one form develops into the other.

Other anaerobes and the banal pus producers, such as the staphylococcus, streptococcus, proteus bacillus, and colon bacillus are the precursors of the gas infection. The incubation period lasts from three hours up to from ten to twenty days. Most often, the symptoms appear from one to two days after the injury. The gas abscess is a circumscribed suppuration around a retained piece of shot, a foreign body, or piece of clothing forced into the wound. In gas phlegmon the skin is usually unchanged, not red, pale, brown, or cool. The cellular tissue is cushion-like; the gas is located in the muscles and in the connective tissue. The characteristic symptoms include severe pains at the site of the injury, a feeling of unbearable tension, rapid breathing, and a moist tongue which later becomes dry; consciousness is usually retained. The temperature ranges between 39° and 41° C., but later becomes subnormal. The pulse is between 120 and 160. The blood pressure falls to 80 or 90.

Therapeutically, prophylaxis is the most important consideration. Primary excision of the wound may come up for consideration in the treatment of the wound within six hours; the simplification of complicated wound conditions, the removal of foreign bodies, the escape of the secretions, and the fixation of the extremity are of special importance. The author favors open-wound treatment with constant chloride irrigations in infections of severe injuries of the extremities, especially when the bones and joints are also injured. He uses a 1 per cent boracic-acid-chloride solution.

The anaerobic infections during peace times occur mostly in veterinary practice. Serum therapy is an important weapon in the fight against this infection. Since the World War the production of serum has been greatly improved. The Behring Works produce an excellent polyvalent serum; its prophylactic dose is from 10 to 50 c.cm.; its therapeutic dose, 10 c.cm.

given in the vicinity of the focus or intravenously; this dose can be repeated frequently. The transfusion of native blood has a good effect. Gas-gangrene infections did not occur in the fall of 1938 and spring of 1939 during the battles in Upper Hungary. The author sees the reason for this in the fact that the injuries from artillery shots were rapidly diminishing, and also that the excellently organized transport and care of the wounded made surgical treatment possible in a very short time.

(E. Illés). Louis Neuwelt, M.D.

Meleney, F. L.: The Use of Zinc Peroxide in the Treatment of Diabetic Gangrene of the Lower Extremities. *Surgery*, 1939, 6: 845.

The importance of bacteriological studies in connection with diabetic gangrene is stressed. At the earliest possible time aerobic and anaerobic cultures from several areas of the lesion should be taken. Usually there is a mixture of organisms, the synergistic action of which is likely to produce serious consequences, particularly in diabetic individuals. Zinc peroxide is considered the antiseptic that is most effective in minimizing the establishment of infection at the time of the original injury, or at the first loss of surface protection. Zinc peroxide may also be used during the period of preparation before operation, if organisms such as hemolytic streptococci and all types of anaerobic organisms are present. If these bacteria are present at the site of amputation, the use of zinc peroxide is recommended to prevent infection in the stump, or if infection develops in the stump, zinc peroxide should be used at once to control such infection. Should reamputation be required it should be done immediately to prevent the establishment of infection in the second operative site. The zinc peroxide, which is not chemically pure, should be suspended in sterile distilled water and applied to every part of the wound surface, after which the wound should be covered with fine meshed gauze which has been soaked in the same material. This should be covered with compresses saturated with sterile distilled water and the compresses should be covered with vaseline gauze or some other impermeable material to prevent evaporation. Dressings are changed every twenty-four hours: the old material is irrigated off, and a new dressing is applied.

Walter H. Nadler, M.D.

ANESTHESIA

Tuohy, E. B.: Respiratory Physiological Phenomena During Inhalation Anesthesia. *Arch. Surg.*, 1939, 39: 1001.

This paper concerns some of the important features of gas anesthesia from the standpoint of preoperative medication, physiological phenomena associated with the administration of most inhalation anesthetic agents, and supportive measures for the patient during anesthesia.

In order to allay fear and promote rest, it is customary to administer a sedative agent to most patients before the operation. Usually, morphine sulfate is given because it promotes rest and diminishes the patient's perception for pain. Although, as a rule, opium derivatives do not produce sleep except when administered in large doses, they do enhance the effect of most soporific drugs such as bromides and barbiturates. For this reason it is common practice to use some such agents as pentobarbital sodium (nembutal), sodium amytal, or various other barbiturates and bromide preparations in conjunction with opiates.

The dosage of any drug, especially when used for premedication purposes, should be sufficient to produce a safe pharmacological effect. It is not believed by the author that it is possible to state any specific dosages for every individual. Inasmuch as the basal metabolic rates of individuals vary widely, it is important to bear in mind that the different drugs vary diversely in the intensity of their action.

The mechanism of inhalation anesthesia is very complex and depends upon many factors. Some of the most important of these are the physical laws which determine the diffusion of gas and vapors, and the anatomical, physiological, and chemical considerations incident to respiration. During induction with an inhalation anesthetic the concentration or partial pressure of any given anesthetic agent is higher in the alveolar air than the partial pressure of the agent in the blood and tissue. The rate of diffusion of the anesthetic into the blood stream is rapid at first, and depends somewhat upon the area of alveolar membrane which is exposed to the gas and the rapidity of pulmonary circulation. As the concentration of the anesthetic rises in the blood, the rate of diffusion of the anesthetic agent from the alveoli decreases and an equilibrium is established between the partial pressure of the gas in the alveoli and that in the blood. When anesthesia is discontinued, a reverse process occurs, and at first there is a rapid elimination of the anesthetic agent from the blood and the tissues into the alveoli of the lung. Gradually this is followed by a slower elimination of the agent, as the concentration of the agent increases in the alveolar spaces. The importance of hyperventilation of the lungs with oxygen and then air at the termination of an anesthetic is quite apparent when one considers the mechanism of the diffusion of gases.

One must keep this physiological process in mind when administering an inhalation anesthetic agent because there are many factors which will influence the process of diffusion of gas and vapors into the blood stream. Stridor may occur as a result of administering an anesthetic agent too rapidly, and in this case the stridor is usually due to the irritating action of the anesthetic on the vocal cords. Also, it may be attributable to indirect stimulation of other tissues, such as traction on the pelvic and abdominal viscera.

The treatment of stridor due to too concentrated mixtures of anesthetic agents is usually simple and is accomplished by diluting the anesthetic vapor with

oxygen. If stridor occurs when traction is made on viscera, it is frequently more difficult to correct, and the situation is usually embarrassing to the anesthetist. Laryngeal spasm may be produced in relatively deep, as well as light, surgical anesthesia when visceral traction is made, and it seems that the most effective remedy is intratracheal intubation. Occasionally an increase in bag pressure will help to reduce the stridor and decrease the noise incident to the vibration of the vocal cords. The difficulties encountered with this procedure are: the possibility of distending the stomach with gas, and the fact that the procedure is tedious and wasteful of gases. When an inhalation anesthetic is administered to young children by the closed method, or by the so-called carbon-dioxide-absorption method, one should employ a type of gas machine and carbon-dioxide-absorber unit which will require the least expenditure of respiratory effort on the part of the child. The "to-and-fro" type of apparatus, employing an absorber placed between a face mask and breathing bag, probably requires less effort than the type of gas machines using so-called circle-breathing units.

In the presence of narcosis and anoxemia with a diminished oxygen supply to the brain and medulla, the addition of carbon dioxide may cause a momentary stimulation of the respiration, but at the same time it will increase the demand of the center for oxygen, which is already at a low level even prior to stimulation with carbon dioxide. The resultant effect is momentary respiratory stimulation followed suddenly by hypopnea and apnea. The only treatment for a condition of this nature is the administration of sufficient oxygen to rejuvenate the medullary center of the brain. If the cells of the respiratory center are very severely depressed either from narcosis or from anoxemia, and have lost all their power of reacting to carbon dioxide, the addition of this agent may cause a further narcotic action and respiration may cease after one or two breaths.

It is also recognized that anoxemia will stimulate respiration, but its action is due to the production of certain afferent impulses, with resultant reflexes around certain nerve receptors in the region of the carotid sinus and the ascending aorta. It is not generally believed at the present time that anoxemia produces a direct stimulating effect on the respiratory center, but rather that oxygen lack in the cells of the respiratory center is a definite depressant.

The stimulus effected through anoxemia by the receptor in the region of the carotid sinus which causes hyperpnea is not a mechanical one, as are the stimuli of some of the reflexes originating in this region, which play a part in the control of pulse rate and blood pressure; but rather it is a chemical stimulus. According to several investigators, this reflex, originating from the carotid receptor in response to the stimuli of anoxemia, is more resistant to the deleterious effects of anesthetic agents, narcotic drugs, anoxemia, and excessive concentration of carbon dioxide, than is the reflex originating in the respiratory center. The reflex stimulation of respiration by anoxemia must not be allowed to be present for any length of time because irreparable damage may be done to the body tissues, especially those of the brain. Oxygen should be administered in order to abolish the anoxemia.

There are other neurogenic reflexes which originate in the lungs, often referred to as the Hering-Breuer reflexes, which regulate the rate and depth of inspiration by nerve impulses traversing the vagus nerve.

It should be clear that the respiratory signs of anesthesia are tremendously important and deserve as much consideration as any one physical sign that may be demonstrated during inhalation anesthesia. Except in certain circumstances, vasomotor and cardiovascular aberrations usually occur simultaneously with respiratory changes or inadequacies, and one should be alert to detect depressions in the blood pressure, alterations in the pulse rate, and other signs of impending shock.

In many cases of impending shock before capillary paralysis has occurred, one usually finds a marked degree of vasoconstriction because the vasomotor center is still active, at least for a time, until anoxemia supervenes and depresses the center. It is not wise to administer a vasoconstrictor agent such as epinephrine when the blood vessels are already markedly constricted. It is much more advantageous to restore the circulatory blood volume by means of the intravenous administration of solutions, preferably blood, in order to insure a medium upon which the heart can work. The opportune moment for the use of vasopressor agents occurs when the systolic blood pressure has not fallen to very low levels; that is, not below 70 or 80 mm. of mercury. When vasoconstrictors are administered sufficiently early the vasomotor tone and systolic pressure can be maintained for a reasonable length of time—at least long enough to permit relatively simple venipuncture.

There are many factors other than the anesthetic itself which influence or hasten so-called surgical shock, some of which are hemorrhage, heat loss, sweating, trauma to tissues, and duration of the surgical procedure. All these conditions should be considered during the administration of the anesthetic and it is advisable to synchronize the depth of anesthesia and specific supportive measures as far as possible with the physical status of the patient at varying intervals during the operation.

SURGICAL INSTRUMENTS AND APPARATUS

Bower, J. O., Burns, J. C., and Mengle, H. A.: The Superiority of Very Fine Catgut in Gastro-Intestinal Surgery. *Am. J. Surg.*, 1940, 47: 20.

Various operations were performed upon the stomach and duodenum of dogs in order to compare the amount of trauma and tissue reaction produced by chromic catgut, sizes 0 and 5–0, and iodized catgut in corresponding sizes. The sutures used were affixed to atraumatic needles of suitable sizes.

Following vertical bisection of the stomach and suture of the mucosa, submucosa, and serosa, the

gross mucosal changes in the specimens sutured with 5–0 chromic catgut showed immediate accurate primary union and a strong anastomotic line because of the absence of necrosis. The gross mucosal changes in the specimens sutured with 0 chromic showed early necrosis of the mucosal edges, extending over a period of from seventy-two to ninety-six hours, exposure of the catgut strand, frequent untying of the catgut knot, and a minimum of accurate primary union. Microscopically, there was noted in the specimen sutured with 5–0 chromic, minimal destruction of cells because of the fine calibers of the needle and catgut; there was minimal tissue irritation as shown by almost complete absence of leucocytic infiltration, and there was prolonged retention of catgut in the tissue. Suture lines made with 0 chromic catgut, on the other hand, showed maximum destruction of cells because of the large caliber of the needle and the drawing through of a large catgut strand, early absorption of catgut beginning at the end of seventy-two hours, more marked at the end of ninety-six hours, and almost complete at the end of one hundred and twenty hours. Leucocytic infiltration of the tissue accompanying absorption increased commensurately, reaching its maximum on the fifth day.

Following gastroduodenostomy with 5–0 chromic catgut, there was minimal mucosal necrosis and inflammatory reaction with accurate union of the apposed mucosal edges. No. 0 iodized catgut, however, showed gross changes similar to, and frequently more marked than those observed in the anastomotic line in the stomach when 0 chromic catgut was used, i.e., early mucosal necrosis, exposure of the catgut strand, inflammatory edema, and retraction of the anastomotic line.

Longitudinal incisions were made in the duodenum and sutured with 5–0 chromic, 0 chromic, and 5–0 iodized chromic catgut, respectively. The specimens were rendered transparent by a modification of the Spalteholz method, and the suture lines which were studied demonstrating the following:

No. 5–0 chromic catgut produced minimal tissue irritation; capillary proliferation occurred early; and rapid accurate union resulted. No. 0 chromic catgut produced marked tissue irritation and slow union of the mucosal surface. When 5–0 iodized catgut was used the mucosa in most instances was completely, and the serosa partially disrupted.

Transparent specimens of stomachs in which horizontal incisions were sutured with 0 and 5–0 chromic catgut, respectively, presented absolute evidence corroborating the conclusions reached after the microscopic studies of the cross sections of catgut; the finer catgut, 5–0 chromic, remains longer and produces less irritation than the larger, 0 chromic. Capillary budding extended toward and over the anastomotic edge earlier when 5–0 catgut was used, which accounted for the solidity of union in the divided mucosa in these specimens.

No. 5–0 chromic and 0 chromic catgut were also used to suture the peritoneum, the rectus abdominis muscle, and the deep fascia of young dogs. Cross sections of tissue removed and studied microscopically for ten days revealed that the 5–0 chromic strand remained intact longer and produced minimal tissue irritation as compared with the larger 0 chromic catgut strand.

The results of these experimental studies were verified by clinical investigations. The practical value was repeatedly demonstrated in surgery of the gastro-intestinal system and biliary tract; in suture of the dura, tendons, and nerves; and in the surgery of children.

No. 5–0 chromic catgut may therefore be used to replace larger sizes of sutures in a variety of surgical operations. When close and uniform apposition, together with minimal trauma and cellular reaction are essential, it is especially indicated.

SAMUEL H. KLEIN, M.D.

Giliberti, P.: Research on the Antigenic Power of Catgut (Ricerche sul potere antigene del catgut). *Policlin.*, Rome, 1939, 46: sez. chir. 555.

In order to ascertain whether catgut reactions are of anaphylactic nature and consequently specific, Giliberti sensitized 10 guinea pigs with catgut powder and, three weeks later, investigated their degree of hypersensitivity to heterogenous serums (sheep, horse, and ox) and to the proteins of the smooth musculature of the intestine of sheep. To demonstrate eventual anaphylactic sensitization in the animals, he used the method of Battelli-Friedberger, which consists in allowing Ringer's solution, alone and combined with the antigen to which the sensitization of the animal is to be tested, to circulate through the previously exsanguinated posterior extremities of the experimental animal; anaphylactic sensitization toward the antigen used is revealed by an intense vasoconstriction which causes a decrease in the fluid issuing from the prepared vessel; the amount of issuing fluid is given in numbers of drops.

None of the experimental animals showed a degree of vasoconstriction that allowed acceptance of the presence of sensitization toward the serums tested: in fact, the number of drops counted in the 10 sensitized guinea pigs was increased as well as decreased within unimportant limits. The extract of intestinal musculature of sheep always caused a vasoconstriction, the degree of which was the same in sensitized and control animals and could therefore not well be attributed to a specific hypersensitivity.

In a second series of experiments, the author investigated whether the methods used to sterilize catgut change its proteins to the point of making them lose their antigenic power. In the first group, he sensitized 3 guinea pigs with the intestinal musculature of sheep, 3 with this material sterilized at 140° C. for four hours, and 3 with this material kept in a solution of iodine for five days; in all of the animals, he induced the circulation of the extract of intestinal musculature and of sheep, ox, and horse

serum. In the second group, he repeated the same experiments but used horse serum instead of the intestinal musculature of sheep as anaphylactogenic material, because horse serum easily produces anaphylactic shock in guinea pigs and thus eliminates the possible error of attributing the absence of anaphylactic reaction to the lack of anaphylactogenic power of the proteins of the intestinal musculature of sheep for guinea pigs; it also eliminates the vasoconstrictive action of the muscular extract which might mask the vasoconstriction due to anaphylactic shock. Five guinea pigs were sensitized with a suspension of horse serum dried at low temperature (about 40° C.), 5 with dried horse serum which was sterilized at 140° C. for four hours, and 5 with dried horse serum which was kept in iodine solution for five days. Fresh horse serum was made to circulate in all these animals.

In the first group, only 1 of the 3 animals sensitized with extract of the intestinal musculature showed, during the circulation of the muscular extract, a vasoconstriction of higher degree than that caused in normal animals, and all the animals of the group presented insignificant vasomotor response to the circulation of the serums. Consequently, the proteins of the intestinal musculature of sheep, although capable of sensitizing guinea pigs, cannot induce anaphylaxis in this species. On the other hand, none of the animals sensitized with sterilized muscular extract has given any response to the circulation of the antigens used; this fact shows that sterilization alters the normal antigenic power of the proteins of the intestinal musculature. These results are confirmed by those obtained in the second group: simple drying of horse serum at low temperature conserved its antigenic power and the animals showed a typical anaphylactic reaction to the circulation of fresh horse serum, while sterilization abolished the antigenic power.

These experiments impose the conclusion that catgut is incapable of causing anaphylactic reactions in subjects treated with heterogenous serums because the usual methods of sterilization of catgut deprive it of its antigenic power; in addition, the intestinal musculature of sheep (and catgut even more so) is incapable of inducing specific anaphylactic sensitization. However, it is an open question whether or not a previous treatment with catgut may have sensitized an individual to a second introduction of catgut. RICHARD KEMEL, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Rubin, E. L.: The Delineation of Articular Cartilage by X-Rays Without the Aid of Contrast Media. *Brit. J. Radiol.*, 1939, 12: 649.

Articular cartilages may exceptionally cast shadows on the roentgenogram in pathological conditions when calcification or ossification is present but they are not visible otherwise on films made in the ordinary manner. It is the purpose of this paper to describe and illustrate the roentgenographic delineation of normal articular cartilage in certain joints by simple manipulative procedures. Brief reference is made to previous work done by others along this line.

The knee joint is particularly suited to demonstrate cartilaginous outlines, but the shoulder and metacarpophalangeal joints also permit visualization under certain conditions. Detailed descriptions of the procedures necessary are given and numerous roentgenograms illustrating the findings are included. The radiolucent space appearing between the cartilages, by virtue of which they are rendered visible, is explained on the basis of gas exuding into the joint space from the fluids in which the tissues are bathed because of the negative pressure or vacuum produced by the manipulation. Support is given to this theory by the fact that the interarticular translucency is not demonstrable when recognizable effusions in the joint are present.

Attention is called to the fact that a thin linear translucency separating the articular surfaces is occasionally encountered as an accidental finding in a joint which has been roentgenographed without previous manipulation. It is assumed that conditions are accidentally produced momentarily in these cases, having the same effects as procedures followed to bring it about. This explanation seems plausible in view of the fact that similar findings are practically never demonstrable on check-up examinations. Comment is also made on the translucency in the symphysis pubis in the later stages of pregnancy, described by Roberts, but it is not considered due to analogous conditions.

No attempt is made to appraise the possible clinical value of delineating articular cartilage, but the information yielded by the method merits a full clinical investigation. One case demonstrating its value is cited. Its use to detect small accumulations of fluid in joints is suggested.

ADOLPH HARTUNG, M.D.

Reuter, E. G., and Reeves, R. J.: Roentgen Pelvimetry; A Simplified Method. *Am. J. Roentgenol.*, 1939, 42: 847.

The authors describe in detail their method of roentgen pelvimetry, which necessitates the use of 2 anteroposterior and 1 lateral film. By the use of their method the obstetrical conjugate, transverse diameter of the inlet, right and left oblique, and biischial measurements are obtained. They report a favorable comparison of the results of roentgen pelvimetry by this method with the results of the postmortem measurements. Three case reports are given to illustrate the application of the method in each of the three non-gynecoid types of pelves. It is believed that the method presented is technically simpler than other methods; it has the advantage that the mass of tissue penetrated by the roentgen rays is smaller because of the utilization of the supine position.

HAROLD C. OCHSNER, M.D.

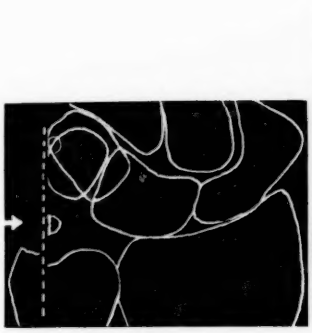
De Almeida Toledo, P.: Roentgenological Examination of Acute Conditions of the Abdomen (O exame radiologico no abdomen agudo). *Arq. de cirurg. clin. e exper.*, 1939, 3: 203.

The author discusses the value of roentgenological examination in the diagnosis of gastro-intestinal perforation, obstruction, acute inflammatory processes, acute non-surgical conditions of the abdomen, and false acute conditions of the abdomen. In all of these types of cases x-ray examination has proved to be of inestimable value, as it demonstrates the size, position, and lack of mobility of the appendix; increased haustration; abnormal position of the diaphragm; and the presence of air, diverticula, inguinal hernia, stenosis of an artificial gastro-intestinal stoma, renal calculi, torsion of the sigmoid, megacolon, diaphragmatic hernia, volvulus of the stomach, and intestinal intussusception. Not only does a roentgenological examination facilitate the surgical intervention by disclosing the cause of the acute condition, but it also prevents unnecessary operations by revealing conditions not requiring immediate interference, e.g., hydronephrosis, and ureteral or pancreatic calculi.

JOSEPH K. NARAT, M.D.

Bagozzi, I. C.: Numerical and Morphological Anomalies of the Bone at the Site of the Ulnar Styloid and Parastyloid Processes (Anomalie scheletriche numeriche e morphologiche in sede stiloidea e parastiloidea ulnare). *Radiol. med.*, 1939, 26: 1104.

Radiograms of the radiocarpal articulation taken some time after a trauma sometimes show morphological anomalies which are difficult of interpretation. This is a problem of accentuated difficulty when there is an insurance or medicolegal question involved. In such cases the radiological evidence is of preponderating importance. The most common sites for debatable osseous anomalies are the ulnar styloid and the parastyloid processes and their vicinity. The author classifies these anomalies as follows: (1) bone anomalies definitely related to trauma etiologically (Fig. 1); (2) bone structures



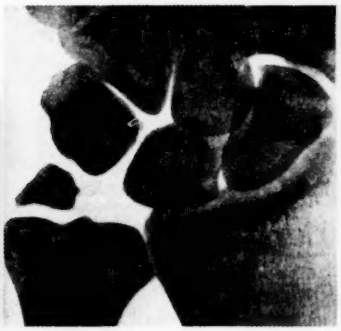


Fig. 1. Fig. 2. Fig. 3.

Fig. 1. In case of fracture of the tip of the styloid process the avulsed fragment is dislocated distally and toward the center of the wrist so as to pass beyond a line prolonging the lateral margin of the ulnar styloid process.

Fig. 2. Independent ossification of the styloid process of the ulna so as to assume the appearance of an individual supernumerary bone.

Fig. 3. Anomalous formation with the appearance of a supernumerary bone at the parastyloid process of the ulna, associated with a morphological anomaly at the inferior extremity of the ulna.

which definitely originate from an accessory nucleus of ossification of the styloid apophysis and do not unite with the inferior extremity of the ulna (Fig. 2); and (3) bone formations which arise from ossification of pieces of cartilage which develop normally in the wrist toward the termination of its development (Fig. 3).

In the traumatic cases the fragment of bone is displaced distally and toward the center of the wrist as indicated in Figure 1. In the anomalies of ossification the bone formation is located at the site normally occupied by the styloid apophysis. There is an equality between the anomalous formation and the styloid process on the other wrist.

JACOB E. KLEIN, M.D.

Brailsford, J. F.: The Radiological Evidence of Malignancy in Bone Tumors, and Its Relation to Biopsy. *Radiology*, 1939, 33: 476.

The investigation of tumors of bone is difficult in the important early stages when treatment can still be of avail. Patients usually present themselves with lesions which were insidious in onset, and were first noted after insignificant trauma or pathological fracture, or after a tumor mass had developed. Investigation may include: (1) conservative treatment and observation, (2) surgical exploration and biopsy, and (3) roentgenological examination. Examination of a bone lesion which suggests tumor because of localized pain or swelling should consist first of roentgenography. Brailsford advises radical surgical therapy on the basis of definite malignant tumor in the roentgenograph, in spite of vague or minimal clinical evidence.

History of insidious development of a bone lesion in a previously healthy individual is corroborative, as is absence of a history of previous inflammatory disease, such as sepsis, pneumonia, scarlet fever, or typhoid. Urine, blood, and sputum examinations may give a clue. Cases in which there still is doubt are best handled by immobilization and repeated x-irradiation over a period of time, although the author does not state how long he would wait before investigating surgically for histological material.

Surgical biopsy (aspiration biopsy is not mentioned) is advised even when a second or third test may be necessary to establish the diagnosis. There are, however, pitfalls in histological interpretation as, for instance, faulty selection of material. If the lesion is small, accurate roentgenological localization before biopsy is advisable. The pathologist

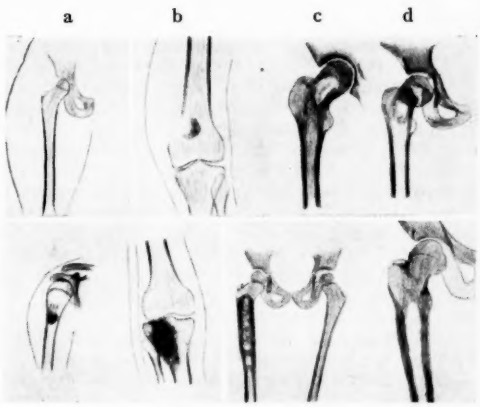


Fig. 1. a, Periosteal sarcoma in youth 22 years of age; b, c, d, osteolytic sarcoma; e, f, osteosclerotic sarcoma; g, h, Ewing's sarcoma.

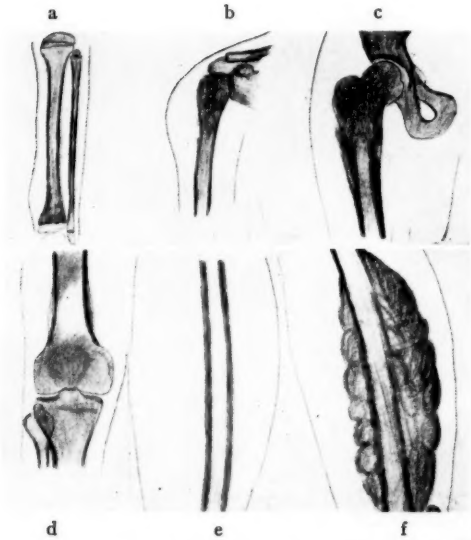


Fig. 2. Types of periosteal reaction associated with malignant tumor of bone.

needs to know all the clinical facts, especially if the part had received previous radiotherapy. The surgeon should remember that a liquefied tumor often closely resembles pus and all such material should be examined under the microscope. Brailsford has seen tumor in one fragment of a fracture while another remained free of such disease. Roentgenographic study should include in difficult cases comparative films of the opposite limb, stereoscopic films, and soft-tissue films.

The characteristic radiological changes in early stages of malignant bone tumor are as follows:

1. In periosteal sarcomas as seen in adolescents there is early in the disease only fusiform swelling of the limb without bone change (Fig. 1a). Later a thin layer of periosteal new bone forms. In the fibrosarcoma of adults irregular wisps of calcium and, later, localized peripheral erosions of bone are seen.

2. In osteolytic osteogenic sarcoma there may or may not be a soft-part swelling (Fig. 1b). The ill defined area of osteolysis is near the diaphyseal end of the long bones and the adjacent periosteum and medulla will usually show sclerosis (Figs. 1b, 1c). Pathological fracture may occur (Fig. 1d).

3. Osteosclerotic tumors show predilection for similar sites, are irregular in outline, and may be associated with periosteal reaction (Figs. 1e, 1f).

4. Ewing's sarcoma characteristically is seen in the shaft of long bones. The medulla is expanded and crossed by coarse trabeculations. The cortex is thick and sclerosed, irregular only on its inner surface (Figs. 1g, 1h).

5. Typical periosteal reactions in osteogenic sarcoma are seen in Figure 2; (a) palisade spicules and sclerosis of shaft associated with normal epiphyses. (b) periosteal cuff, (c) periosteal accretions, (d) regular periosteal thickening and central rarefication, (e) palisade spicules and no other changes, and, finally, (f) massive irregular periosteal new bone.

The author believes that simple and malignant bone tumors must be differentiated in clinical and roentgenological as well as histological findings. Furthermore, early amputation is the treatment of choice for malignant bone tumors when roentgenological evidence of distant metastasis is absent. Radium and x-ray treatment does not prevent distant metastases. JOHN L. POOL, M.D.

Hemmingson, H.: Arteriographic Diagnosis of Malignant Glioma. *Acta radiol.*, 1939, 20: 499.

Cerebral angiography requires the exposure of the carotid bifurcation and injection of 6 c.cm. of thorotrast into the internal carotid artery. If the common carotid artery is injected, a greater amount of thorotrast is required. The arteriogram is taken toward the end of the injection, the phlebogram three seconds after the completion of the injection.

The method is indicated particularly in vascular malformations and in tumors. Arteriovenous aneurysms can be mapped out and their inlets and outlets can be established pre-operatively. Arterial aneurysms, which are usually localized to the intracranial portion of the internal carotid, are readily revealed. The arteriogram taken in the anteroposterior projection demonstrates the brain surface, delineated by the end-branches of the vessels, to be forced inward from the inner table of the skull.

One hundred and seventeen cases of arteriographed cerebral tumors were studied in a five-year period. Thirty-six instances of malignant glioma were found, and 64 per cent of them presented a characteristic appearance. There is an abundance of new vessels within the tumor, and the vessels have an irregular course and varying caliber. Between the vessels there are irregular opaque spots of smaller size, which represent miliary aneurysms. In addition, arteriovenous fistulas are often seen, with contrast filling of one or more veins. An atypical group (comprising 22 per cent of the total) of malignant gliomas is noted by a more regular hypervascularization, with a streak or broom-shaped arrangement of the vessels, and without any visible patches of contrast material or arteriovenous aneurysms. Thus in 86 per cent the vascularization of the malignant glioma enabled its exact localization through arteriography. Among 23 cases of benign glioma none showed vascularization of the tumor.

In meningiomas the common carotid artery should be injected as the nutrition of meningiomas is usually maintained from the external carotid via the middle meningeal arteries. The convexity meningioma is seen in the arteriogram to be surrounded by circular arteries running around the tumor. In the

phlebogram the meningioma appeared in 2 cases as a rather diffuse, not fully homogeneous opaque spot.

Two of 6 metastatic cerebral tumors presented a characteristic appearance. In the arteriogram there was a faint indication of a diffuse shadow of contrast medium; in the phlebogram, annularly arranged, there were exceedingly slender irregular vessels in the periphery of the tumor, apparently corresponding to vessels in the tumor capsule.

HAROLD C. OCHSNER, M.D.

Bignami, C.: Modifications in the Blood Picture as a Result of Roentgen Therapy Employing 350 Kilovolts (Modificazioni del quadro ematico in seguito a roentgenterapia a 350 kv). *Radiol. med.*, 1939, 26: 1015.

Bignami reports a series of cases of carcinoma of the cervix treated by radium and deep roentgen therapy. His cases fell chiefly into Grade II of the Geneva Classification, although a few were of Grade I and certain others of Grade III. The lesions treated were almost exclusively of the squamous-cell type. The age of the patients varied from forty to sixty years; the average body weight was between 50 and 60 kgm., and the general condition was good. Cases presenting local complications and intercurrent disease were discarded from the series reported. The patients were treated first by radium introduced into the uterus and subsequently by deep roentgen therapy. The radium treatment lasted from seven to nine days, the total dose varying from 55 to 60 millicuries. The irradiation of the pelvis was carried out by two routes, the hypogastric and the sacral. The 350-kv. apparatus was employed with 4 ma., a filter of 1 mm. of copper plus 1 mm. of aluminum, a half-value layer of 4.32 mm. of copper, a target-skin distance of 80 cm., and a rate of dosage of 9 roentgens per minute; the two fields represented 320 sq. cm. each and both fields received 3,000 roentgens, in fractions of 150 roentgens daily. With the use of the 170-kv. apparatus, the milliamperage was 3, the filter as before, the half-value layer 1.21 mm. of copper, the distance 50 cm., the rate 5.7 roentgens per minute, and the size of the field from 250 to 400 sq. cm. Examinations of the blood were made before and after radium therapy, and repeated before and after the roentgen therapy which was given after an interval of forty-five days; they were made subsequently after one and two weeks, and one, two, and three months.

Determinations showed a moderate initial decrease in the erythrocyte as well as in the hemoglobin count, followed by an increase after two weeks or more, which, however, was not sufficient to restore the original values. The leucocytes also showed an initial decrease, more marked than that of the red cells, which in time was succeeded by a slight increase, again not substantial enough to bring about a restitution of the control values. The leucopenia was further characterized by a marked absolute lymphopenia with a modest relative eosinophilia and neutrophilia. The behavior of the monocytes and basophils varied according to the individuals and the time intervals. Morphological changes were not observed either in the white or in the red series, and no immature forms were seen. In general, little difference was found between the blood pictures presented after treatment with 350 kv. and after treatment with 170 kv., except that the latter possessed a certain uniformity, in contrast to the less predictable result obtained with the former.

The author presents his conclusions not as indices to the condition of patients after intensive irradiation therapy, but as a stimulus to further investigation directed toward the various tissues and organs involved in such treatment.

EDITH FARNSWORTH, M.D.

Schinz, H. R.: Possibilities and Limitations of the Cure of Cancer by Radiation (Possibilidades e limites da cura do cancro pelas radiações). *Arq. de patol.*, 1939, 11: 258.

Within seventeen years the author treated 2,529 cases of cancer, with cure in 17 per cent. This figure is even more impressive when one takes into consideration the fact that only very few cases of skin cancer were included in the material. The average age of the patients was fifty-three years; 61 per cent were men and 39 per cent women. In order of descending frequency the site of the cancer was as follows: upper respiratory and digestive organs, 30 per cent; breast, 16 per cent; esophagus, 10 per cent; stomach, intestines, and other abdominal organs, with the exclusion of the ovaries, 10 per cent; skin and natural orifices, 10 per cent; malignant goiter, 4 per cent; lungs, bronchi, and mediastinum, 4 per cent; ovaries, testes, prostatic gland, and urinary bladder, 4 per cent; skeletal system, 3 per cent; nervous system and hypophysis, 2 per cent; and uterus, 1 per cent.

In 83 per cent of the cases cure did not take place, but in one-half of this group considerable amelioration was obtained; 25 per cent of the total number of patients remained well for at least one year, but after five years the number of complete cures was reduced to 13 per cent. The success of the roentgen therapy becomes more obvious when one considers the fact that 75 per cent of the cases were inoperable.

JOSEPH K. NARAT, M.D.

Schinz, H. R., Zuppinger, A., Pagani, A., and Walther, O.: A Review of the Results of Roentgen Therapy of Malignant Tumors During the Year 1938 (Bilanz ueber die Bestrahlungsresultate der malignen Tumoren im Jahre 1938). *Roentgenpraxis*, 1939, 11: 335.

The fundamentals of roentgen treatment have remained the same during the year 1938. The authors report on the treatment of 304 benign and 992 malignant tumors. The two most important methods of treatment which they employed were the simple fractionated and the protracted fractionated methods. Radium treatment as a preliminary procedure was not employed as the authors could not do any

distance radium therapy and most of the patients were in advanced stages of the disease. Two hundred and ninety-two were treated as in-patients.

Of the 993 patients with malignant tumors 56 per cent are symptom-free; 1 per cent have died, symptom-free, of intercurrent disease; 14 per cent are benefited; and 10 per cent are still under treatment. As few patients presented themselves in the early stage of the disease, the authors dealt principally with palliative measures. In spite of this there was a definite improvement noted in 77 per cent of the cases, even though it was only temporary in some.

Among the 56 per cent of the patients who were symptom-free all the malignomas, i.e., sarcomas and carcinomas, were found. It was remarkable that in addition to the 56 per cent mentioned, there were 49 patients who were symptom-free but later had recurrences, who were then treated again, and again became symptom-free. Regarding the multiplicity of lesions, there were 9 patients (5 per cent), among 166 who remained free of recurrence for five years, who developed a second tumor. In 3 of these the second tumor, in all probability, was independent of the first. The authors conclude that in cases of multiple tumors the second is probably not a manifestation of the original disease if it occurs after a long time; it is a true second primary tumor.

Of special interest is the fact that 240 cases of sarcoma, not to mention the giant-cell tumors, the lympho-epithelial tumors, and the melanomas, were kept under control. Sixteen per cent were treated surgically and roentgenologically and 84 per cent were treated roentgenologically only. Only 13 per cent of the total were operable, while 87 per cent were inoperable. Of the 257 cases in which at least a year had passed since the cessation of treatment, 9 per cent presented no symptoms; of 223 with at least a three-year interval, 20 per cent presented no symptoms; and of 201 with a five-year interval, 15 per cent presented no symptoms. The permanent results in the operable cases were good: 63 per cent presented no symptoms for at least one year; 56 per cent presented no symptoms for three years; and 35 per cent presented no symptoms for five years. In the inoperable cases the results were much worse: 23 per cent of the cases presented no symptoms for one year; 14 per cent presented no symptoms for three years; and 10 per cent presented no symptoms for five years. Seventy-five per cent of all of the cases of sarcoma were not cured, but of these 62 per cent were influenced favorably so that the patients lived on an average of twelve and two-tenths months. (FRANZ). LEO A. JUHNKE, M.D.

Evans, W. A., and Leucutia, T.: Deep Roentgen-Ray Therapy of Mammary Carcinoma. Fifteen-Year Results in a Formerly Published Group and a Statistical Analysis of 1,200 Cases Treated between 1922 and 1937. *Am. J. Roentgenol.*, 1939, 42: 866.

As the title indicates, the article is divided into two parts: (a) the first is a continuation of two former publications in 1925 and 1930, on a carefully selected series of 172 cases of mammary carcinoma treated between 1922 and 1924, which were studied systematically year by year; and (b) the second contains an analysis of 1,200 routine cases of mammary carcinoma treated between 1922 and 1937.

Clinical classification. Throughout the entire period, the following classification of mammary carcinoma was used; it depended on the stage of clinical extension:

I. Carcinoma localized to the breast proper.
II. Extension to the axillary lymph nodes.
III. Extension to the supraclavicular, infraclavicular, and cervical lymph nodes.
IV. Extension by lymphatic permeation of the chest wall leading to nodular skin metastases, pleural metastases, and pleural effusion.
V. Distant metastases.

From the point of view of therapeutic procedure, there were three subdivisions:

A. Combination of surgery and radiation therapy.
B. Radiation therapy alone.
C. Radiation therapy in recurrent or metastatic cases formerly treated by surgery.

Fifteen-year observations. In the entire group of 172 cases, comprising all clinical stages and all forms of treatment, 30 per cent of the patients survived the five-year, and 14 per cent the fifteen-year periods. In the operable group, in which a combination of radical (or semi-radical) surgery and extensive postoperative radiation therapy was used, 71 per cent survived the five-year, and 47 per cent the fifteen-year periods when the carcinoma was localized to the breast proper, and 47 per cent survived the five-year, and 20 per cent the fifteen-year periods when there was extension to the axillary lymph nodes.

The most important observation in connection with this group was the establishment of the fact that a local recurrence (or metastasis) may occur even in the earliest stages of mammary carcinoma at any time despite the most radical surgery and very extensive postoperative radiation therapy. Thus of 51 patients, who were apparently well at the five-year period, 16 died of carcinoma between the six-year and fifteen-year periods, and only 11 of other causes than cancer. Moreover, recurrence in the operative scar was not infrequently observed, even in cases of A-1, as late as from twelve to fifteen years after the initial treatment. Therefore, it appears unwise to speak of a "five-year cure" in mammary carcinoma and the term "survival" is more appropriate for the designation of the late results.

Statistical analysis of 1,200 cases. In presenting the results in this group, yearly follow-up tables according to the method of treatment and clinical stage are given for all cases. Then the five-year survivals are compiled for 830 cases and the ten-year survivals for 434 cases. The following is a comparative tabulation:

SUMMARY OF FIVE AND TEN YEAR SURVIVALS
(1922–1933)

	Group	Stage	Five-year survivals: Total patients	Five-year survivals: Patients alive	Five-year survivals: Per cent	Ten-year survivals: Total patients	Ten-year survivals: Patients alive	Ten-year survivals: Per cent
1	A	I–II	305	105	50	170	71	42
	B	I–II	15	9	60	6	3	50 (30)
	C	I–II	34	13	38	21	7	33
2	A	III	113	34	30	50	7	14
	B	III	12	3	25	7	1	14
	C	III	58	17	29	40	4	10
3	A	IV–V	66	6	9	34	—	—
	B	IV–V	63	—	—	20	—	—
	C	IV–V	164	11	7	86	2	2
Total cases of all groups and stages			830	243	30	434	95	22

A study of the effect of age distribution on the five-year and ten-year survivals leads to some interesting and quite significant observations.

AGE DISTRIBUTION OF THE FIVE AND TEN YEAR SURVIVALS IN THE OPERABLE GROUP (A I-II)

Age group	Average	Cases	Five-year survival per cent: Mammary carcinoma	Five-year survival per cent: Normal life	Five-year survival per cent: Corrected value	Ten-year survival per cent: Mammary carcinoma	Ten-year survival per cent: Normal life	Ten-year survival per cent: Corrected value
Up to 39	35	67	54	97.6	56	47	94.8	52
40–49	45	106	52	96.2	56	44	90.8	53
50–59	53	79	42	93.2	49	28	85.9	44
From 60 up	65	53	51	82.6	78	46	61.2	85

Thus it seems that (1) the mammary carcinoma does not have a more malignant course in younger than in middle-aged patients. This is in contradistinction to carcinoma in other locations of the body; (2) the poorest results were obtained between the ages of fifty and fifty-nine, which suggested that the onset of natural menopause has no beneficial effect on the course of mammary carcinoma; and (3) at an older age, the malignancy of mammary carcinoma decreases with advancing years. This fact is borne out also by the observations made in connection with Group B (first table). It, therefore, implies that in case of poor, or even doubtful, operative risk, one may rely on irradiation alone in treating such cases.

Conclusions. Surgery continues to remain, as before, an important part of the treatment of carcinoma of the breast. Every case that is operable should be subjected to surgical intervention at the earliest possible moment. Even in the inoperable cases, some sort of operation may appear necessary from time to time during the course of irradiation. There can be no doubt, however, that radiation therapy is also of paramount value both as an adjunct to surgery in the operable, and as a primary method in the inoperable cases.

RADIUM

Fontana, G.: The Action of Radium Emanation on the Genital Organs (Azione della radioemanazione sugli organi genitali). *Riv. ital. di ginec.*, 1939, 23: 1.

For his study, Fontana used 18 immature rats, weighing from 55 to 60 gm.: 6 served as controls, 6 were treated for twenty-five days, and 6 were treated for forty days. All received the same diet, but the milk of the controls was diluted with plain water and that of the treated animals with irradiated water. Irradiated water was obtained by placing a radium container, capable of delivering 10,000 Maché units per twenty-four hours, in a hermetically sealed bottle of 1 liter of water.

After twenty-five days, the controls weighed 80 gm. and the treated animals 90 gm. The vagina had opened and the estrus had started at about the same time in the two groups, but the cycles were closer together in the treated animals (three or four days as against four or five days for the controls) and there was more desquamation. All the abdominal organs of the treated animals showed marked hyperemia, while those of the controls seemed bloodless.

After forty days, the controls weighed 110 gm. and the treated animals 130 gm.; the hyperemia of the abdominal organs of the latter was still more marked. Two animals of each group were placed with a male and all became pregnant and had normal litters.

Histological examination of the genital organs and of the hypophyses of the animals treated for twenty-five days showed more advanced development than those of the controls; this was still more evident after forty days of treatment.

The author estimates that each treated rat absorbed from 300 to 400 Maché units of emanation per day. This dose stimulated all the functions of the organism: the animal was more lively, its coat in better condition, and its weight greater; the estrus cycles occurred more frequently, the ovarian follicles ripened more rapidly and in greater numbers, the vagina and the uterus were more developed, and the hypophysis was better irrigated and showed more chromophil cells.

It is evident that, besides the stimulation of the genital organs by the ingested substance, it is necessary to admit also a hypophysary stimulation which gradually added itself to the former. With regard to the action of the emanation, a number of ionization processes are caused in the organism, with great sensitivity and receptivity of the substrate toward these processes, and these factors explain the notable general actions obtained by small quantities of emanation; the radiating energy produces changes in the molecular structure which lead to the formation of biocatalyzers or to the creation of active compounds similar to vitamins. It would seem that in some dysfunctions of the general and genital endocrine system one might advantageously replace hormone therapy by therapy with radium emanations.

RICHARD KEMEL, M.D.

Paterson, R., and Tod, M. C.: The Radium Treatment of Angioma in Children. *Am. J. Roentgenol.*, 1939, 42: 726.

From the therapeutic standpoint, the angiomas are divided into three types: (1) capillary, (2) compact, and (3) cavernous, although not infrequently two or all three types may occur together. The capillary angioma is the port-wine stain, a flat purplish discoloration often covering large areas. The compact angioma includes solid masses of hemangioblasts which have not differentiated to form vessels; in the skull they may be confused with meningiomas, and in the subcutaneous tissues, because of lack of discoloration, with fibromas. The cavernous angioma, if the term is properly used, infers the presence of large blood spaces, but in practice all palpable tumors when combined with the characteristic discoloration of the hemangiomas are usually referred to as cavernous.

The treatment may consist of (a) surgical incision, (b) cauterization, and (c) irradiation. The last is the method of choice for all but capillary angiomas. For small lesions, beta irradiation is sometimes indicated, but for all other types gamma irradiation is to be preferred.

The authors' method consists of applying silver radon seeds on a mold built up from elastoplast or elastoplast felt, which then is fitted to the lesion to be treated. The seeds are best arranged in a circle by making the ratio of the diameter of the treating circle to the radium skin distance just under 3 to 1, and the dose is calculated from graphs in milligram hours or, more recently, in roentgens. The mother of the child is told to remove and burn the entire mold when the irradiation is completed, which, as a rule, takes five or six days. If radium needles are used, instead of radon seeds, the mother is advised to have the child brought back to the hospital at a fixed date for the removal of the mold. If the angiomas are located on irregular surfaces, such as the lip, the nostril, or near the eye, or if the tumors are very bulky, the implantation of permanent gold radon seeds or removable small radium needles leads to better results.

The best time to treat an angioma is during infancy, from the age of three months to two years. The dose is somewhat modified according to age, but it must be kept low enough to avoid any but the very slightest reaction. For elastoplast molds the dose is fixed at 1,500 roentgens over a period of four days, or 1,000 roentgens over a period of two days, repeated at two-month intervals for a total of 2 or 3 applications. If implants alone are used from the beginning, the dose is fixed at 2,000 roentgens for very young children, and at 3,000 roentgens for older children, from plane implants; or 1,000 roentgens at 2 cm. from a point source usually produces complete disappearance of the lesion with one treatment.

The results obtained are very satisfactory both from the clinical and the cosmetic standpoint. Of 150 children treated at the Manchester Radium Institute during the period from 1933 to 1936, inclusive, 129 are well at the present time, 13 have been benefited, and only 8 showed no response to the radium irradiation. T. Leucutia, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Moniz de Bettencourt, J.: The Functions of the Carotid Body (Sur les fonctions du corpuscule carotidien). *Presse méd.*, Par., 1939, 47: 1557.

The obscurity of the rôle of the carotid body is indicated by the fact that it has been regarded by different authors as an appendage of the nervous system, an endocrine gland, or even a vascular glomus. Evidence is presented in this article to show that the carotid body has both receptive and secretory functions.

It is known that the carotid body is part of the reflexogenous carotid zone, or carotid sinus, which comprises the initial portions of the internal and external carotid arteries and the other smaller vessels which are detached from the bifurcation. These vessels and the carotid body are permeated with branches of a nervous plexus composed of ramifications of the glossopharyngeal, the vagus, and the sympathetic fibers.

It has been shown by Heymans and others that the carotid sinus region is sensible to both mechanical and chemical excitants. The author tried to localize these functions by isolating limited vascular segments. Noting that the artery of the carotid body in the dog arose from the occipital artery, or from the external carotid near the origin of the occipital, the author utilized the following procedures: (1) embolization of the small vessels in the region of the bifurcation, (2) ligation of the occipital artery at its origin, (3) ligation of the external carotid proximal to the origin of the occipital or of the artery of the carotid body, and (4) clamping of the artery of the carotid body. The results indicate that mechanical sensibility is localized to the initial portion of the internal and external carotid arteries while the principal point of departure of the chemical reflexes is from the carotid body.

Secretory function is very strongly suggested by the histological composition of the organ. It is composed chiefly of epithelioid cells which are disposed in islands, the center of each being occupied by a capillary. The principal cells are small, but at the periphery one finds very large, pale cells which are incontestably chromaffin.

Microchemical researches have shown the presence of small amounts of adrenalin within the carotid body. The author studied the effect of adrenalin upon the isolated carotid sinus and found that it produced the reflexes of hypotension, bradycardia, and bradypnea, independently of changes in the intracarotid pressure. This may indicate a mode of regulation of the sympathetic tonus, the sympathetic excitation provoking the secretion of adrenalin which in turn acts upon the nerve of Hering to reflexly inhibit sympathetic tonus.

It is probable that adrenalin is not the only substance elaborated by the carotid body, as the chromaffin cells constitute only a small portion of the organ. The author prepared an extract of the carotid body which, when injected intravenously, produced an extreme bradycardia. It was found that the latter was abolished by vagal section, thus establishing this action of the extract as being central. Enough of this vagotonic substance could be obtained from one single carotid body almost to stop the heart. It is believed, therefore, that it is probably elaborated by the principal cells of the organ.

The evidence indicates that the carotid body, while acting as a receptor sensible to chemical changes in the blood, also secretes adrenalin and a vagotonic substance, and may assist in maintaining the proper balance of sympathetic and parasympathetic tonus. FRANK MCDOWELL, M.D.

Harris, R. I., Perrett, T. S., MacLachlin, A.: Fat Embolism. *Ann. Surg.*, 1939, 110: 1095.

Fat embolism, though uncommon, is a more frequent complication of fracture and of operations on bone than is commonly supposed. The recognition of this condition is difficult not only clinically, but at autopsy as well. Clinically, a rather characteristic sequence of events occurs in most cases, which may lead to a recognition of the condition. The sequence is as follows: (1) an injury to a bone or an operation upon a bone; (2) an interval of freedom from symptoms other than those resulting from the injury or operation; (3) the development of pulmonary and cerebral signs and symptoms. Recovery or death follows. In addition, fat globules may be found in the sputum or urine occasionally, or petechial hemorrhages may appear in the skin. These findings are of great clinical value, but frequently are not present. In fatal cases coming to autopsy, the true nature of the process is frequently not recognized because of the fact that routine preparations of autopsy material dissolve the fat, and only by special stains and preparations can the condition be diagnosed microscopically.

A fatal case of fat embolism is presented in detail. A fractured femur was followed by death in five days. Before death, marked pulmonary and cerebral symptoms developed. A striking feature of the case was the occurrence of a profound drop in hemoglobin and erythrocytes. Between the third and fifth day, the hemoglobin dropped from 72 to 30 per cent. At autopsy both lungs were found to be consolidated, dark red in color, and to have the appearance of liver. On microscopic examination the exudate of the lungs was found to be composed almost entirely of erythrocytes and fluid. The enormous amount of exudate was sufficient to account for the sudden fall in hemoglobin and erythrocytes.

A review of certain operatively treated bone conditions indicated that this rather marked drop in hemoglobin and red blood cells was not uncommon postoperatively, and could not be explained on the basis of operative blood loss. The rapidly developing anemia in these cases and in other fatal and non-fatal cases was assumed to be the result of extravasation of the blood into the lungs and other tissues surrounding fat emboli.

In order to confirm the above hypothesis a number of experiments were conducted on rabbits in which human fat was injected intravenously. It was found that 0.9 c.cm. of neutral human fat per kilo of body weight, injected in one dose, was the minimal lethal dose. Much larger total doses were necessary to produce death if the total dose was divided and given at different intervals. At postmortem examination the alveoli of the lungs of these animals were shown to be filled with hemorrhagic exudate.

An attempt was made to solve the question of why a bland substance, such as human fat, produced such a marked hemorrhagic reaction. The possibility that the irritating qualities were the result of splitting of the neutral fats into glycerol and fatty acids by tissue lipase was considered. Experimental evidence seemed to confirm this theory, for as little as 0.07 c.cm. per kilo of body weight of hydrolyzed human fat was sufficient to produce death in rabbits, and this hydrolyzed fat produced the pulmonary hemorrhagic exudate resembling that seen in fat embolism.

The authors point out that the rapid and marked fall of the hemoglobin and erythrocytes in suspected cases of fat embolism is a valuable confirmatory sign of the rather unusual complication of fat embolism.

LUTHER H. WOLFF, M.D.

Mondor, H., Ducroquet, R., and Olivier, C.: Some Surgical Aspects of Kussmaul-Maier's Disease (Quelques aspects chirurgicaux de la maladie de Kussmaul-Maier). *J. de chir.*, 1939, 54: 604.

Mondor and his associates note that periarteritis nodosa (Kussmaul-Maier's disease) is rarely diagnosed during life, and suggest that it may not be as rare a condition as has been supposed; most of the cases are reported from the pathological departments of hospitals where numerous autopsies are made.

In the case reported the patient came under the authors' observation when she was twenty years of age; both feet were deformed and fixed in an abnormal position; the arterial pulsations in the lower part of both legs were diminished; the left hand was deformed, and there was a loss of substance of part of a finger due to a previous gangrenous process; there was also some loss of substance from the nose, likewise due to previous gangrene.

The history showed that ten years previously the patient had had an acute febrile attack, simulating rheumatic fever, with a polymorphous exanthem, dry gangrene of one finger, and numerous subcutaneous nodules; a diagnosis of periarteritis nodosa was made. The patient recovered from this attack, but had minor febrile attacks for two years, accompanied by the development of subcutaneous nodules; the deformities then began to develop, and for the last three years she had been unable to walk because of the deformity of the feet, although she suffered no pain. To correct the deformity of the feet, the authors chose as simple an operative procedure as possible because of the condition of the skin and the diminution of the arterial pulsations. Operation was done on the right foot first and consisted only of a tenotomy. After this the foot was immobilized in a bivalved plaster cast; the wound healed well, and the results were satisfactory. Operation was then done on the left foot; the considerable ankylosis of the ankle joint was first corrected surgically, and then a tenotomy was done with satisfactory results. There was definite improvement in the local circulation in both extremities following the operation.

While in this case surgery was employed only to correct deformities resulting from periarteritis nodosa, a review of the literature shows that the periarteritis may involve the internal organs and give rise to other symptoms that are indications for operation. Among these conditions are appendicitis, perirenal hematoma, hematuria of renal origin, mesenteric infarcts, and gastric or intestinal lesions that perforate and cause peritonitis. Some of these conditions, especially the latter group, are terminal incidents, and their true nature is discovered only at autopsy.

Periarteritis nodosa may cause or may simulate appendicitis. There were 9 cases of this type collected from the literature in which operation was done and in 7 of them the patient subsequently succumbed to periarteritis nodosa.

ALICE M. MEYERS.

Askanazy, M.: Factors Influencing the Development of Neoplastic Metastases (As condições que realizam as metástases neoplásicas). *Arq. de patol.*, 1939, 11: 230.

There are striking analogies between infectious and neoplastic metastases. The author maintains that parasites invade only territories prepared by chemical substances present in the bodies of the parasites, and he believes that a similar hypothesis may be applied to malignant tumors.

For development of metastases the presence of a primary tumor is, of course, necessary, but its location cannot always be easily detected. If metastases developing by contact, inoculation, or implantation are left out of the discussion, it may be said that a vascular penetration is essential for the development of a metastasis. Pressure alone is apparently not sufficient to allow such penetration because benign tumors do not form metastases and intracranial tumors, in spite of an enormous pressure, only rarely enter a sinus. Furthermore, the walls of arteries offer a considerable resistance to the in-

vasion by a malignant tumor, whereas venous and lymphatic capillary walls do not. Virchow's law, according to which cancer cells are carried with the lymph flow and sarcomatous cells are propagated through the blood, is still valid.

The time element is an important factor in the creation of metastases. The time of development of a metastasis depends not only on the vascular aggression but also on the growth energy of the embolized tissues. A nearly rhythmic periodicity may be noticed in the proliferation of tumors, which has been proved experimentally by Bashford.

The frequency of metastases is determined to a great extent by location of the primary tumor: for instance, cancer of the lung produces secondary tumors much more frequently than cancer of the face; cancer originating in the parenchyma or in the excretory canals of the pancreas remains a local growth as a rule, while an insuloma has a tendency to produce generalized metastases. Young, nondifferentiated neoplastic tissues are characterized by a multiplicity of metastases. The latter develop particularly easily in pregnancy.

The site of metastases is determined chiefly by the lymph and blood circulations, this fact explaining the great frequency of secondary tumors in the liver. A retrograde transport of a neoplastic thrombus from a hypernephroma through the renal vein may reach the femoral vein. The excellent blood supply to the gray substance of the brain, chorioid plexus, or bone marrow explains the great frequency of metastases in such locations and, conversely, the rarity of secondary tumors in cartilage or corneas becomes self-explanatory. Furthermore, the selection of the site of metastases is governed by biochemical affinities of the neoplastic cells and the metabolism and constitution of the cells of the host; for instance, metastases following a carcinoma of the prostatic gland show a predilection for bones. Chemical or physicochemical factors probably are responsible for the rarity of metastases in the skeletal muscles and those of the heart.

The pH of the pulmonary tissue, viscosity of the blood increased by evaporation of water, respiratory movements, and cytolytic properties of the serum have been made responsible for a lesser frequency of metastases in the lungs than might otherwise be expected. According to Seeman, an intravascular digestion of malignant cells by the walls of the pulmonary blood vessels is an important factor, and is analogous to the rôle of pulmonary arterioles and capillaries in the destruction and resorption of other emboli, such as fat, and placental or megacaryocytic cells.

The relative rarity of metastases in the spleen is possibly attributable to reactive phenomena, poor development of the lymphatics, and contractility of the organ.

The author hopes that a continuous study of factors important in the formation of metastases will eventually reveal means of suppressing them.

JOSEPH K. NARAT, M.D.

Rondoni, P., and Beltrami, W.: The Influence of Tumors Due to Hydrocarbons on the Growth of Transplants of Tumors Caused by Hydrocarbons (Influenza dei tumori da idrocarburi sulla crescita di trapianti di tumori pure indotti da idrocarburi). *Tumori*, 1939, 25: 585.

Rondoni and Beltrami state that the results of recent studies indicate that a pre-existent malignant tumor does not exercise any inhibiting influence on the development of a new tumor caused by tar. Haddow has claimed, on the basis of his experiments, that cancer-producing hydrocarbons inhibit normal and pathological growth and retard the growth of transplanted and spontaneous tumors, although tumors due to hydrocarbons offer some non-specific resistance to the inhibiting action of the hydrocarbons. The authors decided to investigate how the cells of the tumor which was caused by the chemical agent behave, after several homologous transplantations, toward the organism in which the cancerigenous agent has been inoculated with good results some time previously and in which little of the agent is still present, although its effect on the cells persists in the form of neoplastic proliferation. Subcutaneous injections of solutions of cancerigenous hydrocarbons (3, 4-benzpyrine and methylcholanthrene) in lard were made in rats, and after the development of sarcomas, grafts of from second to sixth generation transplants of sarcomas originally induced in rats by benzpyrine were made in the opposite groin. For control, rats without pre-existing tumors were given the same graft of transplantable benzpyrine tumor.

The experiments showed that the transplants did not meet with any obstacle to their growth; consequently, the organism in which the malignant cells were produced offered no resistance to the same kind of cells introduced by transplantation from another homologous organism. As recent studies have shown that traces of benzpyrine persist in the organism for a long time, the traces remaining in the induced tumor did not influence the growth of the transplants deriving originally from a tumor which itself was caused by hydrocarbons. Another conclusion of the experiments is that the transplants have always taken better in animals bearing a tumor than in the controls without pre-existing tumor. As the animals used in the experiments were genetically non-homogenous, the regularity of the results obtained in various groups and at different times is rather suggestive: it may be the effect of involuntary selection of genetic factors favorable to the growth of tumors due to hydrocarbons—the transplantation of hydrocarbon tumors on animals already bearing tumors produced by the inoculation of hydrocarbon. However, special selection was not made, as rats of about the same weight were taken and those with smaller or uncertain tumors were not rejected. Perhaps the growing tumor places the organism in a condition of hyper-receptivity for transplants of the tumor produced originally by the chemical agent, or the growing tumor produces

substances which favor the growth of neoplastic cells of common origin. RICHARD KEMEL, M.D.

Bartlett, M. K., Jones, C. M., and Ryan, A. E.: Vitamin-C Studies on Surgical Patients. *Ann. Surg.*, 1940, 111: 1.

Research by Aschoff (1919) and Wolbach (1926, 1934, 1936) indicated that Vitamin C was necessary for the formation of intercellular cement substance. Lanman and Ingalls (1937) demonstrated the decreased tensile strength of healing wounds in scorbutic guinea pigs. In the present study blood and urine measurements of Vitamin C in surgical patients were made. Vitamin C in the blood plasma of 13 normal subjects ranged from 0.77 to 1.62 mgm. per 100 c.cm. of plasma. In 121 hospital patients suffering from tuberculosis, ulcerative colitis, osteomyelitis, carcinoma, arthritis, or peptic ulcer, and 67 with miscellaneous diagnoses, the values ranged from 0.0 to 1.89 mgm. per cent. Two-thirds of these hospital patients had blood Vitamin-C values below 0.5 mgm. per cent, that is, a Vitamin-C deficiency. In 8 patients consecutive determinations of Vitamin C in the blood and urine before and after operation indicated a fall in the blood level but no increase in excretion. Increased utilization was, therefore, suggested. To test this assumption, the blood levels produced by the intravenous injection of 1 gm. of Vitamin C were determined. Before operation a sharp rise occurred; after operation for several days such an injection produced only a slight increase. The authors conclude that the more rapid clearance from the fasting blood of Vitamin C administered intravenously following operation is possibly dependent upon an increased need for this substance in the process of tissue repair and wound healing. PAUL STARR, M.D.

DUCTLESS GLANDS

Uyldert, I. E.: The Assay of Cortical Hormone. *Endocrinology*, 1939, 25: 871.

The assay of adrenal cortical hormone (cortin) in dogs based upon clinical symptoms, principally appetite and body temperature, is described. This assay is apparently as reliable as when based on chemical changes in the blood.

The symptoms of insufficiency are sharply defined. Four syndromes are apparent when the test is based on the following:

(1) Good condition, no insufficiency symptoms. Body temperature normal, from 38° to 39° C.; normal appetite, 60 calories per kgm. of body weight consumed; positive water balance, i.e., more fluid taken up than excreted as urine.

(2) Slight insufficiency. Temperature subnormal, from 37° to 37.9° C.; appetite slightly diminished, part of the food refused.

(3) Insufficiency. Body temperature from 36° to 37° C.; all or nearly all of the food refused; negative water balance; vomiting, diarrhea, and adynamia.

(4) Severe insufficiency. Body temperature may fall to from 34° to 36° C.; all food refused; negative water balance; vomiting and diarrhea; dog prostrated; lowered pulse rate; gingiva cold.

In most of the dogs the first symptom of slight insufficiency was partial refusal of food. Subnormal body temperature was not always evident. In some dogs the refusal of food began only when the temperature was below 37° C. Those dogs with a temperature of from 37° to 37.9° C. and with a normal appetite had only a slight insufficiency. When the temperature was from 37.5° to 38° C. and all food was refused the dog was considered to have a slight insufficiency. When the temperature was lowered to from 37° to 37.5° C. and vomiting occurred the condition was considered to be one of insufficiency.

The largest dose of extract that can possibly be assumed to be positive is tested first; then it is diminished until the dog has an insufficiency. The choice of assay period is arbitrary; a period of four days is sufficient for one dose of extract. It is necessary to determine the limiting dose in a large number of dogs and to check this dose with the limiting dose of a known standard extract. Water-balance experiments are of little value for the assay, but from large numbers of estimations it is concluded that in insufficiency the fluid excretion is increased in relation to the fluid intake. SAMUEL H. KLEIN, M.D.

Uyldert, I. E., Thomassen, J., Waterman, L., and Oestreicher, F.: The Examination of the Blood of Normal and Adrenalectomized Dogs in Relation to Cortin Treatment. *Endocrinology*, 1939, 25: 877, 885.

The potassium and sodium contents of blood plasma and the non-protein nitrogen and glucose contents of whole blood were investigated in 7 normal dogs. In the experience of the authors, unilateral adrenalectomy produced no marked alterations in these factors, whereas significant variations were found to occur following bilateral adrenalectomy.

Through the use of the clinical symptoms of appetite and body temperature to determine the degree of adrenal insufficiency, a significant difference in the blood chemistry of dogs in good condition from that of those having a slight insufficiency was found only with regard to the potassium level. Thus an increased plasma potassium may be regarded as one of the first laboratory findings in adrenal insufficiency. Between dogs who have a slight insufficiency and those who have a definite insufficiency a significant change was found only in the non-protein nitrogen level.

From their observations the authors state that the sharp difference between various degrees of adrenal insufficiency which can be determined clinically, by observation of appetite and body temperature, cannot be adequately recognized from a study of changes in the blood chemistry. For the practical assay of cortin, under experimental conditions, clin-

ical observations are more valuable than studies of the blood-chemistry.

Observations on 5 dogs maintained in good health by cortin injections failed to confirm the work of those who report changes in the blood picture of adrenalectomized animals. No significant changes were observed in the red-cell size, volume, or hemoglobin content, or in the leucocyte or differential counts. An increased hematocrit value during severe insufficiency could be demonstrated in only 2 dogs.

EDWARD W. GIBBS, M.D.

Howard, J. E., and Vest, S. A., Jr.: Clinical Experiments with Male Sex Hormones. Further Observations on Testosterone Propionate in Adult Hypogonadism, and a Preliminary Report on the Implantation of Testosterone. *Am. J. M. Sc.*, 1939, 198: 823.

Studies extending over a period of two years on the effects of testosterone propionate given by hypodermic injections to 22 adult patients with hypogonadism showed the development or re-establishment of secondary sex characteristics with the induction of normal libido and potentia. Increase in size of the testes, epididymides, seminal vesicles, and prostate; changes in the breasts, deepening of the voice, and the growth of hair were prominent. A more youthful skin replaced the wrinkled skin, but acne developed frequently. In some patients muscle strength was increased and energy was more sustained. In one youngster the bone age, as measured by epiphyseal centers of ossification, was increased from five and one-half to ten years. The optimal dose was found to be 25 mgm. in oil given subcutaneously or intramuscularly twice a week.

At present, 10 patients are being treated with pellets of from 100 mgm. to 800 mgm. of compressed testosterone, placed into the subcutaneous tissues surgically. The pellets are removed and replaced at regular intervals in an effort to ascertain the amount of testosterone substance given off per unit of time, and the consequent duration of its effect. In this way it may be possible to determine the frequency with which these pellets need be renewed. All patients who have thus far been transferred from injection to pellet therapy have reported enthusiastic and gratifying results. It is as yet too soon to determine whether pellets will be disintegrated with uniform rapidity in all patients. No patients have thus far reported overstimulation effects. Results are encouraging and appear to be equally as efficacious as those following injections; pellet therapy is far less troublesome to the patient, and the saving of material is considerable.

MANUEL E. LICHTENSTEIN, M.D.

EXPERIMENTAL SURGERY

Page, I. H.: The Production of Arterial Hypertension. *J. Am. M. Ass.*, 1939, 113: 2046.

Severe persistent arterial hypertension has been produced in cats, dogs, and rabbits by means of perinephritis induced by cellophane and silk. The kidneys are covered with a cellophane wrapper, but the hilus is left free from any covering. As a result of the perinephritis a thick, fibrocollagenic, constricting hull is formed around the parenchyma. Renal ischemia is thus produced by a method different in principle from clamping of the renal arteries. Removal of the offending kidney or of the hull around the kidney abolishes the hypertension. Denervation of the renal pedicle does not prevent the development of hypertension when perinephritis is induced. Bilateral adrenalectomy in untreated animals abolishes the hypertension. If they are treated with adequate amounts of sodium chloride and adrenocortex extract, slight hypertension persists. The amount of the substance in the blood which combines with renin to form a pressor substance (renin-activator) is increased. It is likely that perinephritis may be an additional cause of arterial hypertension in man.

MANUEL E. LICHTENSTEIN, M.D.

Richardson, A. P.: Cyanosis in Chickens and Mice Induced by Sulfanilamide. *Bull. Johns Hopkins Hosp.*, Balt., 1939, 65: 445.

Cyanosis, noted in the earliest series of patients treated with sulfanilamide, is the most common complication accompanying therapy with this drug. The exact origin of the dark colored blood has not been clearly established. Methemoglobin, sulfemoglobin, an oxidation product of the drug which stained the red cells, and a pigment resulting from exposure of dilute solutions of the drug to ultraviolet rays have been mentioned as the cause of the cyanosis. At the present time it is agreed that methemoglobin is formed in appreciable quantities by many patients under therapy with sulfanilamide. There is not, however, complete agreement as to whether iron pigments can account for the entire discoloration.

Within the past year it has been possible to produce a cyanosis in chickens, pigeons, and mice. The successful production of sulfanilamide cyanosis in these animals most likely can be attributed to the maintenance of a high blood level for a considerable period of time.

In the case of chickens the rôle of the kidney must be of great importance. In this species glomerular filtration is so low that the drug is excreted very slowly. A number of the birds studied showed high blood levels of sulfanilamide in from two to three weeks after a few days' treatment with the drug. It is quite possible that delayed excretion may to a large extent explain the so-called delayed toxicity reported by some investigators. The cyanosis is explained by the formation of methemoglobin.

The feeding habits of mice are such that by mixing sulfanilamide with food a constant blood level can be maintained by continuous absorption rather than by delayed excretion. The results are irregular and are likely to be associated with systemic symptoms. Sulfemoglobin-like pigment accounts for the cyanosis. The incubation of mouse blood with sulfan-

ilamide *in vitro* results in the formation of methemoglobin, just as in the case of chicken blood and human blood. It is likely that the type of diet may account for the difference in the form of hemoglobin. The results, although lending support to the view that non-functional iron pigment may be of major importance in the etiology of cyanosis in man, do not necessarily rule out the possibility that some other factor may also be operating. Considering the fact that the pigment formed in chickens and mice was shown to be different, it would seem possible that still a third factor might be of importance in another species.

Methylene blue exerts a beneficial effect on the sulfanilamide cyanosis in chickens, but not on the mouse cyanosis. MANUEL E. LICHTENSTEIN, M.D.

Follis, R. H., Jr., and Rich, A. R.: Further Studies on the Effect of Sulfanilamide on Experimental Tuberculosis. *Bull. Johns Hopkins Hosp.*, Balt., 1939, 65: 466.

It is much more difficult to attain a high level of free sulfanilamide in the blood in the guinea pig than in the human being. This is true also in the rabbit. In both animals differences in the degree of acetylation of the drug and, apparently, differences in absorption, excretion, or both, make it necessary to administer much larger doses than are necessary in the human being in order to attain and maintain an effective blood concentration of free sulfanilamide. Since the drug is excreted by the kidney and concentrated in the urine, the authors thought that perhaps additional evidence of its activity might be obtained by studying its effect upon renal tuberculosis. As is well known, the guinea pig practically never develops renal tuberculosis during generalized infection, while the rabbit does so almost always. In view of this marked susceptibility of the rabbit's kidney to tuberculosis, the authors' present experiments were carried out on rabbits. Since the rabbit is natively resistant to the human type of tubercle bacillus and highly susceptible to the bovine type, the latter type was used as the infecting organism. The bacilli were injected intravenously. This route of infection produces a more rapidly progressing generalized tuberculosis than that caused by infection by any other route and thus provides a severe test of the efficacy of a therapeutic agent.

This study of the effect of sulfanilamide on experimental tuberculosis in the rabbit confirms the result of previous experiments performed by the authors on guinea pigs, and demonstrates that adequate dosage of the drug, properly administered, has a definite inhibitory effect upon the development of the disease. Individual rabbits exhibit marked differences in the degree to which they acetylate the drug, and in their ability to attain and maintain a high concentration of the drug in the blood following the administration of a given dosage. These differences undoubtedly play a rôle in the determination of the degree to which a given dosage of the drug will exert a beneficial effect upon the progress of the infection in different animals.

The authors stress the fact that no conclusions regarding the effect of the drug upon human tuberculosis should be drawn from these experiments. This is a problem that requires a separate and carefully controlled study. SAMUEL H. KLEIN, M.D.